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THE ROMAN FORT OF GELLYGAER
GLAMORGAN

THE ROMAN FORT OF GELLYGAER

IN THE COUNTY OF GLAMORGAN

EXCAVATED BY THE CARDIFF NATURALISTS'
SOCIETY IN THE YEARS 1899 1900 & 1901

WRITTEN FOR THE SOCIETY
BY
JOHN WARD F.S.A.

PRINTED FOR THE SOCIETY BY
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2.

PREFACE

It is to be regretted that the Roman Occupation of Britain, though of nearly four centuries' duration and fraught with great and lasting issues, should appear on the pages of our national history as but a short and debatable chapter. This is mainly owing to the vague and conflicting character of the documentary material relating to that period, and it is difficult to see how our knowledge can be further enhanced from that source. Rather, must we turn to the evidence of the spade; and it cannot be doubted that the systematic exploration of Roman sites which has been an archæological fashion of late years, is providing a rich store of material for the historian to work upon. The excavations at Silchester and Caerwent will deepen his insight into the conditions of Romano-British city life; while from those on the Wall in the North, and upon the sites of certain forts and camps, he will infer much concerning the military organization and administration of the Province. If the excavations recently conducted by the Cardiff Naturalists' Society at Gellygaer be esteemed (as I think they will be) to have supplied their quota towards the advancement of this knowledge, they will be deemed worthy of all the labour and money that has been expended upon them.

The treatment of the subject is sufficiently set forth in the introductory section. Those in which the various remains are described may, to the general reader, seem to be tediously detailed, but I ask him to bear in mind that the antiquary engaged in a similar exploration will look for full and precise information: for *his* sake it is better to err on the side of diffuseness rather than of brevity. In the section relating to the history of the exploration, I have not hesitated to place on

record some of the mistakes we have fallen into and have learned to avoid, in order that the Society may have the benefit of the experience thus gained for any future operation of a like nature.

The help of those who in various ways contributed to the successful prosecution of these excavations will be noted in the volume or its appendix, I hope, without omission. It now remains for me to here acknowledge the assistance I have received in the drawing up of this Memoir.

My first step was to distribute type-written notes upon the more important buildings of the fort among those members of the Archæological Section of the Society who had taken part in their excavation—Mr. C. H. James, J.P., who directed the work during the first season; Mr. J. Stuart Corbett, the President of the Section; Mr. William Riley, J.P.; Mr. Robert Drane, F.L.S.; Dr. C. T. Vachell; Mr. J. W. Rodger, M.S.A.; Mr. Edwin Seward, F.R.I.B.A.; Mr. George Seaborne; and the Rector of Gellygaer—with a view to their comments and additions. To these I must add Mr. F. Haverfield, F.S.A., of Oxford, who, although not a member of the Section, visited the spot several times, and rendered great assistance by correspondence. These notes were also sent to several other gentlemen not connected with the Gellygaer exploration, but whose names are well known in the realm of Romano-British archæology—Mr. G. E. Fox, F.S.A., one of the excavators of Silchester; Mr. J. P. Gibson, of Hexham; Mr. R. Blair, F.S.A., Secretary of the Newcastle Society of Antiquaries; Mr. C. W. Dymond, F.S.A.; and Dr. J. Anderson, the Director of the National Museum of Antiquities, Edinburgh. In the correspondence which ensued, much light was thrown upon the interpretation of the remains, and generally upon the affinities of our fort with others of the British excavated series. One outcome of this correspondence was a visit to the Wall under the guidance of Mr. Gibson, the pleasant recollections of which will always be with me. To Mr. William Clarke, of Llandaff, I am indebted for useful information in respect to the building construction and materials. Mr. James, Mr. Rodger, and Mr. Haverfield have kindly perused the proof-sheets.

The plans and illustrations demand a few words. Of the recently published plans of Roman forts, no two, except those of Great Chesters and Housesteads, are to the same scale, thus rendering comparison difficult. As the scale of these corresponds with that of the explorers of Silchester and Caerwent, and is that recommended by the Society of Antiquaries, namely, 30 ft. to 1 in., Mr. Rodger wisely decided to adopt it for his general plan of the fort. My more detailed plans had necessarily to be on a larger scale, so in order that they should be easy of comparison, their scale is double and quadruple that of his, namely, 15 ft. and 7 ft. 6 ins. to 1 in. The "half-tone" plates are selected from photographs taken by Miss Neale, Mr. D. Osborne, and Mr. M. T. Seymour. That the present volume is so well illustrated is due to the generosity of Mr. C. H. James, who has undertaken to defray the cost of all plates, blocks, and the lithographing of the plans.

Mr. James, it may be added, drew up a report upon the first year's work, which was printed in the *Transactions of the Cardiff Naturalists' Society*, Vol. XXXI. The Rector of Gellygaer, also, gave a sketchy account of the exploration and its results in *Cymri*, Vol. XX.

JOHN WARD.

*The Welsh Museum
of Natural History, Arts and
Antiquities, Cardiff.
September 9th, 1902.*

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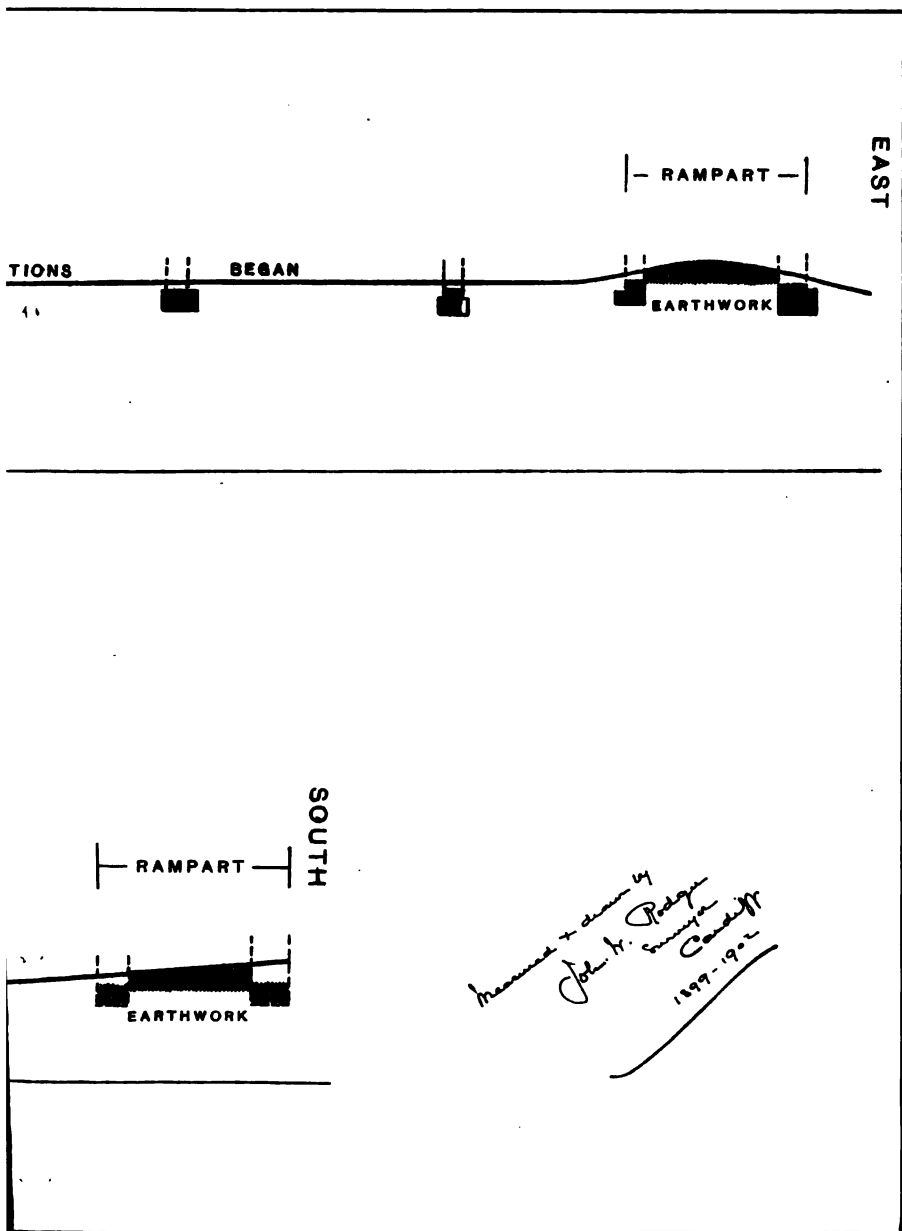
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THE ROMAN FORT OF GELLYGAER.

SECTION I.

Introduction.

IN undertaking this Memoir, I recognize a double duty. The Cardiff Naturalists' Society, as its name indicates and its career has shown, is identified with the pursuit of natural science rather than with that of archæology. Hence, while we may rest assured that all its members have a sympathetic regard for the latter sphere of knowledge, we can scarcely question that those who have made it a study are comparatively few. The recognition of this is important, for it necessitates, in some measure, a different handling of the subject-matter from that I should adopt were I to address myself exclusively to antiquaries. In that case, I should assume the readers to already have a general knowledge of Roman fortification, and should confine myself to the description of the actual remains uncovered at Gellygaer and the conclusions drawn therefrom; but obviously, this would be but dry reading to the many who have not this preliminary knowledge.

In order to place these readers *pari passu* with the subject, I shall give an introductory character to this first section.

The Roman *castra*—the word is only used in the plural form*

* Professor R. S. Conway, Litt. D., in a letter to the author, thus discriminates between the words *castra*, *castrum*, and *castellum*:—" *Castrum* is certainly distinct from *castra*, as 'fort' or 'fortress' from 'camp.' But the singular word died out of use in Latin probably by 100 B.C., save as a proper name applied to various places where forts had or still existed. In classical Latin the diminutive *castellum* was used instead. This had also a special sense to denote the building erected to contain and protect a reservoir which fed more than one aquæduct, at the point where a simple leet was distributed into regular aquæducts for conveying water across a plain. *Castra Stativa* is a good classical phrase for a permanent camp: it occurs frequently in Livy. I know no example of *castellum* being used for anything so large as a camp—but I cannot say precisely how large a 'fort' may have been."

—strictly meant an entrenched camp, such as an army would throw up during a campaign, for it is well known that the Roman army never halted—not even for a single day—without forming a regular entrenchment. Such entrenchments were of a temporary nature, and so contrasted with the permanent camps or *castra stativa*; but for a moment we will disregard the distinction.

The traces of these camps are found wherever the Roman arms penetrated, and in our own country many fine examples are known. So usually are they square or oblong, that this form has come to be popularly regarded as their distinguishing mark. But while this may be accepted as generally true, it must not be too much insisted upon, as exceptional forms occur among Roman camps; and others, not Roman, are occasionally four-sided. Still, in spite of this, the Roman camps have a strong family likeness, and are not likely to be confounded with those of other races and eras.

As indicated above, they fall broadly into two classes—the field camps, in which the defences are of earth-work only and the enclosed area lacks all signs of buildings, and the permanent camps, which are of altogether more durable construction. The latter are generally known as “stations,” but would be better distinguished as *forts*. They were erected to accommodate garrisons, whose duty was to hold what the sword had won, and were placed along the frontiers, by the important sea-ports, and elsewhere where their presence was desired.

Of the ancient writers who touched upon the art of castramentation as practised by the Romans, and whose works remain to us, two stand pre-eminent for the fulness of their descriptions: Polybius, the friend of the younger Scipio (died B.C. 124); and the author of a treatise, *De Munitionibus Castrorum*, who is usually called Hyginus, and who may have lived about the time of Septimus Severus (A.D. 193-211). These two writers treated upon the temporary camps—*castra*—only; yet their statements throw a flood of light on the forts. Allowance, however, must be made for the difference in size between the two classes, the forts being only intended for garrisons, while the great camps of these authorities were designed to accommodate entire

armies, in the one case, of some 20,000 men, and almost double that number in the other.

The Polybian camp was characterized by its simplicity. The site being selected, the position of the general's tent, the *Prætorium*, was fixed upon and marked by a small flag, and from this point the whole camp was developed. A straight line was next drawn through this point in the intended direction of the camp, and at a certain distance this was crossed by another line at right angles. These two lines were termed, in the language of the Roman land-surveyors, the *decumanus maximus* and *cardo maximus*, respectively, and they served as the base-lines from which the whole plan was determined, the sides of the internal divisions and of the general outline running parallel with them. The resultant figure was a square, 2,150 Roman feet each way, bisected in its "length" into two equal parts by the *decumanus maximus*, but in its breadth, or, as the Romans would say, "depth," into two unequal parts by the *cardo maximus*, which was nearer the back than the front. These lines marked the positions of the chief thoroughfares, and of the openings or gates in the rampart through which they passed into the outer space. The transverse road, which, from its importance and great width, was called the *Via Principalis*, passed through the *Porta Principales*, *dextra* and *sinistra*. The great square of the *Prætorium* occupied the middle of its side towards the back of the camp; and from its entrance stretched the main longitudinal road, which passed through the *Porta Prætoria* or front gate of the camp.* A number of minor ways contributed to divide up the interior into rectangular plots for the tents, and between these tents and the rampart was a clear space or *intervallum*, 200 ft. wide, passing round the camp. The rampart itself was of earth, derived from the ditch which formed the outer line of defence.

* There is not complete unanimity as to the identification of the gates, and as to which end of the camp is to be regarded as the front and which the back. I have followed the usual view that the *Porta Prætoria* was the gate towards which the *Prætorium* looked, and that *that* end of the camp was the front. In the description of the Gellygaer fort I shall retain this usage of the words "front" and "back," for convenience sake, but shall replace the classical names for the gates by others expressing their positions with regard to the points of the compass.

Between Polybius and the treatise attributed to Hyginus elapsed 250-350 years, and during this interval great changes took place in the Roman military system. As might be expected, the Hyginian camp reflected the altered condition of things, and to us it is of peculiar interest, as the Roman fortresses of our country are more akin to it than to that of Polybius. The accompanying plan (Fig. 1) is copied from Smith's *Dictionary of Greek and Roman Antiquities*, but in order to make its chief features clearer, many of the minor details are omitted.

The lay-out of the Hyginian camp corresponded in all essentials with that of the Polybian. There were the same rectangular arrangement and bilateral symmetry, the transverse *Via Principalis* with a central *Prætorium* abutting upon it, the longitudinal *Via Prætoria*, and the four gates. But the general outline was an oblong with the corners rounded off; the *Intervallum* was greatly reduced in width; the *Prætorium* was lengthened, pushing forward the *Via Principalis* towards the front, and the *Via Quintana*, instead of crossing the front part of the camp as of old, was now placed behind the *Prætorium*. The chief difference between the two types, however, lay in the altered disposition of the troops, and the smaller space they occupied, as may be gathered from the broad fact that while the Hyginian camp was somewhat smaller than its predecessor, it had to accommodate about double the number of men. The difference in this respect is all the more significant when it is considered that the *Prætorium* and the accommodation for the officers had increased three-fold.

The Hyginian camp was divided by the two transverse roads into three segments, of which the *Prætentura* lay to the front, and the *Retentura* to the back, the middle segment containing the *Prætorium* and its wings or *latæra*, in which were quartered the general's body-guard.

Josephus, in his *Wars of the Jews* (Book III., chapter v.), gives a sketch of a Roman camp in which are interspersed those little touches of detail which mark it as the description of an eye-witness. It is especially interesting to us, for it is highly probable that he wrote it within a few years of the erection of

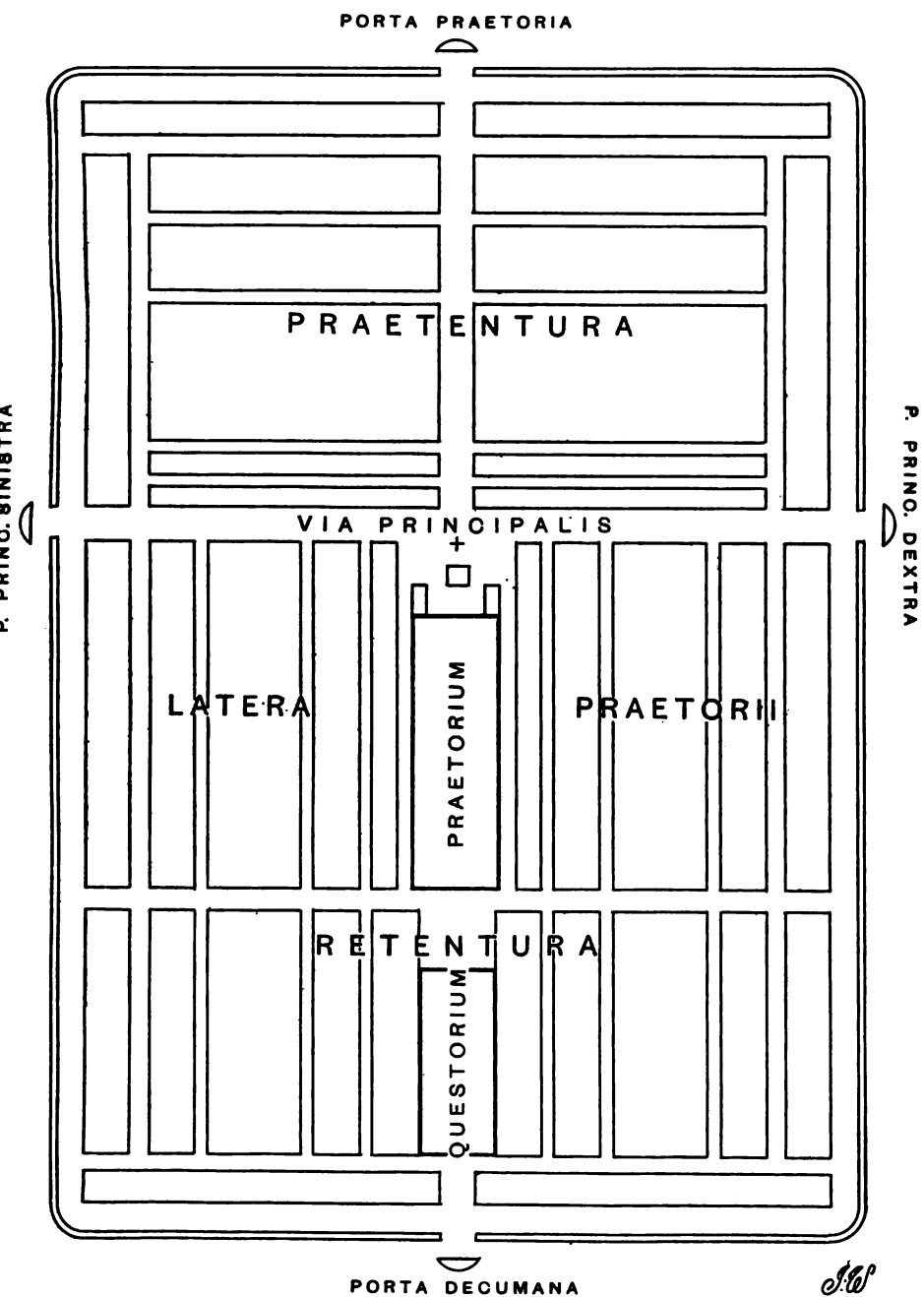


FIG. 1. PLAN OF HYGINIAN CAMP.

the fort at Gellygaer. I will not hesitate, therefore, to make a long quotation.

After describing the discipline and fortitude of the Roman soldiers, he passes to their procedure when in any enemy's land:—"They do not begin to fight till they have walled their camp about; nor is the fence they raise rashly made or uneven; . . . The camp is four-square by measure, and carpenters are ready in great numbers with their tools to erect their buildings for them. As for what is within the camp, it is set apart for tents, but the outward circumference hath the resemblance to a wall, and is adorned with towers at equal distances, where, between the towers, stand the engines for throwing arrows and darts, and for slinging stones, and where they lay all other engines that can annoy the enemy, all ready for their several operations. They also erect four gates, one at every side of the circumference, and those large enough for the entrance of the beasts, and wide enough for making excursions if occasion should require. They divide the camp within into streets, very conveniently, and place the tents of the commanders in the middle; but in the very midst of all is the general's own tent, in the nature of a temple, insomuch that it appears to be a city built on the sudden with its market-place and place for handicraft trades, and with seats for the officers, superior and inferior, where, if any differences arise, their causes are heard and determined. The camp, and all that is in it, is encompassed with a wall round about, and that sooner than one would imagine; and this by the multitude and the skill of the labourers; and if occasion require, a trench is drawn round the whole, whose depth is four cubits, and its breadth equal."

Our knowledge of the permanent camps or *forts* is mainly derived from the evidence of the spade. Only a few of these forts have been sufficiently explored to admit of an insight into the disposition of their buildings and streets; but their plans agree in their main lines, and these lines are those of the Hyginian camp. In fact, we may regard the forts as translations into stone of the temporary camps, provided we look upon them as free, and not as literal, renderings. It is evident that the Roman military authorities did not insist upon hard and fast rules

for the lay-out of the forts, but left much to the discretion of the engineers who built them. The plans are not susceptible of classification, their differences apparently being of an arbitrary nature; but it is quite likely that future investigations will show that some, at least, of these differences signify more than we suppose.

Of the Roman forts which have been explored in this country, those which have supplied the most complete plans are Housesteads (*Borricovicus*) on the Wall in Northumberland, explored by the Newcastle-upon-Tyne Society of Antiquaries in 1898; Birrens, in Dumfriesshire, explored by the Society of Antiquaries of Scotland in 1895; and our Gellygaer. Three other forts have been opened out by the Scottish Society with results almost as excellent—Ardoch, in Perthshire (1896-7); Camelon, in Stirlingshire (1900); and Lyne, in Peeblesshire (1901). Of the Wall series, Chesters (*Cilurnum*) and Great Chesters (*Aesica*) have been partially explored, the former at different times, but chiefly by the late Mr. Clayton, and the latter by Mr. J. P. Gibson and others in 1894-5 and 1897; and in less degree, Birdoswald (*Amboglanna*), the largest of the series, was subjected to the spade in 1852. In the same year a large portion of High Rochester (*Bremenium*), one of the supporting forts of the Wall, was very thoroughly explored by the fourth Duke of Northumberland; and more recently the Newcastle Society laid bare many of the buildings of another supporting fort at South Shields. A small fort on Hardknott, in Cumberland, was explored in a thorough manner by the Cumberland and Westmoreland Antiquarian and Archæological Society between the years 1889 and 1892, mostly under the superintendence of Mr. Calverley and Mr. C. W. Dymond, F.S.A. In Derbyshire, a fort of similar dimensions—Melandra Castle—received a considerable amount of digging in 1899 and 1900 from a local society—the Glossop Antiquarian and Natural History Society—formed for the purpose; but I have not heard whether the work has been continued.

As these forts will be referred to from time to time in these pages, the following table will be useful:—

The Roman Fort of Gellygaer.

FORT.	Dimensions (English feet).		Position of <i>Via Principalis</i> .	<i>Prætorium</i> (English feet).		Where Described.
	Length.	Breadth.		Length.	Breadth.	
Birrens ...	600	381	42'5	78	68	<i>Proc. Soc. Antiquaries, Scot., Vol. XXX.</i>
Ardoch ...	550	490	39'0	86	75	" " " XXXII.
Camelon ...	602	562	42'0	92	120	" " " XXXV.
Lyne ...	580	488	34'4	95	105	" " " XXXIX.
Housesteads ...	609	373	35'1	90	76	Report not yet published.
High Rochester ...	478	438	41'0	76	71	<i>Royal Archaeological Institute, Vol. I.</i>
Chesters ...	573	428	41'0	123	97	<i>Archæologia Æliana, Vols. X., etc.</i>
Gt. Chesters ...	420	347	31'6	78	?	<i>Archæologia Æliana, Vols. XVII. and XXIV.</i>
Hardknott ...	375	375	42'6	70	70	<i>Trans. Cumb. and Westmor. Ant. and Arch. Soc., Vol. XII.</i>
Melandra ...	366	338	48'9	73	72	<i>Derbyshire Archaeological and Natural History Society, Vol. XXII.</i>
Gellygaer ...	402	385	46'0	80	69	This memoir.

The length and breadth are taken from the outer faces of the rampart. Where these faces are not well defined, the measurements have been estimated; and in the case of Melandra Castle there is some uncertainty, as the different plans do not quite agree. The position of the *Via Principalis* is important, as it carries with it the positions of the lateral gates and the *Prætorium*. The figures express the ratio of its distance from the front of the fort to the total length reckoned as 100.

A few other Roman forts in this country have received the attention of the antiquary's spade, but in these cases the excavations have either been confined to the fortifications or have been only slight, disclosing little as to the planning of the internal buildings.

The most important of the Continental forts which have been investigated are the *Kastelle* of the Ober-Germanisch-Rætischer Limes. These differ among themselves about as much as the British examples do, but they have peculiarities which differentiate them as a group from ours.

SECTION II.

The Site and the Surroundings.

THE village of Gellygaer lies between the Rhymney and the Bargoed Taff Valleys, near the north-east corner of Glamorgan, and at a distance of $13\frac{1}{2}$ miles N.N.W. from Cardiff, and of 8 miles S.E. from Merthyr Tydfil. It is finely placed on a spur of Cefn Gellygaer, which, three miles to the N.N.W., attains an elevation of 1,316 ft. above the sea; and, with the exception of that direction, it commands on every side an extensive sweep of characteristic coal-measure country, for this village is in the heart of the eastern portion of the South Wales coal-field. Immediately to the east is Nant Cylla, the stream of which rises in the lower part of Senghennydd Common and falls into the Rhymney two miles to the south. The geological formation consists of upper coal-measure shales and sandstones overlying the pennant-grit; with a sub-soil of stiff boulder clay, containing many pennant fragments, mostly worn, and occasionally ice-scratched.

The site of the Roman fort is 600 ft. to the N.W. of the ancient parish church of St. Cattwg, in a field which from time beyond memory has borne the name of Gaer Fawr—the “Great Camp”—to distinguish it from the Gaer Fach—the “Little Camp”—the smaller adjoining field towards the church, which is supposed to also contain ancient foundations. The Gaer Fawr approximates to the shape of the fort, and includes the whole of it except the north and south corners, the former of which projects into the garden of the Rectory and the latter into that belonging to the old School-house. The N.W. and S.E. fences coincide with the outer faces of the corresponding ramparts, but on the N.E. and S.W. the field oversteps the limits of the fort.

The site is not naturally strong, yet it is well chosen. It occupies a commanding position 780 ft. above the sea, on the brow of Nant Cylla, but is overlooked from the N.W. To be precise, it is set back 200 ft. or more from the line where the steep slope of the valley is transformed into the gentle rise which culminates in Cefn Gellygaer. It will be seen from this, that the site has a gentle fall in a south-easterly direction.

While the name of the field is proof that the memory of the fort never died out, the references to it by topographical writers are very few. The earliest I know of, is in Carlisle's *Topographical Dictionary of the Dominion of Wales*, 1811, which is as follows:—"The present worthy Rector, the Rev. John J. Jones, very obligingly adds, 'The name implies a Military Station embosomed with Wood. The site of an oblong square (*sic*) building is still discernible in fields near the present village Church and Rectory House: and fragments of Roman bricks of superior texture are scattered in the Walls and Inclosures about the Vestigium of the old Camp. In former times it might be an important Out-post to check incursions from the Mountains and to defend the defiles to Caerphilly Castle (from which it is distant about seven miles), and which is still majestic though in ruins.'"^{*}

Before the recent exploration, the chief features of the fort were discernible to an experienced eye, and doubtless will remain so in spite of the disturbance wrought by the explorer's spade. No masonry *in situ* was visible, except a short length, consisting of a single course of the N.W. rampart wall, in the side of the lane leading to the Rectory; but many dressed stones, presumably from the fort, were to be seen in the neighbouring field-fences. In the field itself the indications took the form of gentle rises and falls in the greensward. The rampart, as might be expected, showed out well, and the four gates were represented by shallow hollows. The ditch on the S.W. side was equally well marked, but elsewhere its traces were very

^{*} The account of the remains of the fort in Lewis's *Topographical Dictionary of Wales*, 1835, is apparently abbreviated from Carlisle. There are references to it as Roman, in *Archæologia Cambrensis*, vol. xv., 3rd series, p. 84 (1869), and viii., 4th series, p. 266 (1877).

slight, and on the N.W. side it was quite obliterated by the Rectory lane upon its line. Within the circuit of the rampart the most conspicuous mounds were those marking the sites of Blocks V. and VIII. on Mr. Rodger's general plan, and stretching between these were three square terraced areas representing Blocks VI. and VII. and a yard also shown on that plan. Between this zone of mounds and hollows and the N.E. and S.W. ramparts, the surface-indications were few and obscure; but the line of the *Via Principalis* was very distinct.

The Roman name of the fort, and the nationality and legion of the soldiers who held it, are quite unknown, for no inscription was found during the excavations, and one on a centurial stone, known to exist in 1822, throws no light on the question (page 93). It is off the various routes of the Antonine Itinerary, and to attempt to identify it with any of the names on the lists of Ptolemy and the "Ravenna Geographer" would be pure guess-work.

Its geographical relations to the surrounding Roman positions need not detain us long, for the Roman archæology of the district has never been seriously and comprehensively investigated. There is no doubt that it is upon a Roman road connecting the Gaer near Brecknock with Cardiff Castle. The line of this road can be traced over the high ground of Gellygaer Common, pointing direct to our fort. The last mile-and-a-half before the village is reached is probably represented by the Heol Adam, an existing road popularly accounted Roman, and so marked on the Ordnance Survey. Below the village the old road appears to have made a bend in a somewhat westerly direction, the line probably being represented by the present Heol-Pont-y-Seison, which is also accounted Roman. On the other side of Pont-y-Seison, and near Pen-y-waun, is some ancient pitching which seems to relate to this road. Ascending Mynnydd Eglwysilan, we meet with indications of another bend, this time somewhat towards the east, heading for Caerphilly and Cardiff.

It is well known that Abergavenny, which is thirteen miles to the N.E., marks the site of a Roman station, and one would expect to find some indications of communication between it and Gellygaer, but the Ordnance Survey shows no signs of such

a line of road. There is a mountain road between Llanhilleth and Aber-Sychan, which is *said* to be Roman, but it is considerably to the south of a direct route.

In an opposite direction is Cowbridge (sixteen miles to the S.W.), which appears to have been the next station from Cardiff on the so-called *Via Julia*; but I am not aware that there is any evidence of a Roman road between it and Gellygaer. It may be noted, however, that the Heol-Pont-y-Seison points to that place, and that fragments of an ancient pitched road have been found near Llantrissant running in the same direction.

SECTION III.

The History of the Exploration.

ON July 27th, 1894, the then newly-formed Archæological Section of the Naturalists' Society paid a visit to Llancaiach and Gellygaer, during which the Rector of the latter place, the Rev. Jesse T. Jones, pointed out the outlines of the fort.* The feasibility of an exploration of the site was discussed, but no further steps were taken; still the visit bore fruit eventually. A lecture upon the archæology of Salisbury Plain, delivered by Mr. E. Doran Webb, F.S.A., before the Society, four and a half years later (January 12th, 1899), revived the question; and it was arranged that several members should visit the place on the following day. Mr. Webb accompanied the party, and he strongly urged the excavation of the site. This was warmly entertained by the Committee, who, with the view of testing the nature of the mounds, voted the sum of £25, and obtained the permission of the owner of the land, Mr. Capel Hanbury Leigh, J.P., of Pontypool, and of the tenant, Mr. H. Edwards, for the requisite trenching to be done. The Archæological Section having ceased to exist, the work was entrusted to a sub-committee, which had recently been appointed to co-operate with the Ordnance Survey officers in providing the revised survey of the district with correct particulars of the various ancient remains. Mr. C. H. James, J.P., and Mr. George Seaborne, of Hengoed, consented to superintend the work, and Mr. J. W. Rodger to make the survey.

Operations on the spot began early in the following October, and were continued until the middle of November. The trenching was confined to a portion of the site extending from the west

* In 1892, Roman pottery was found in the Rectory grounds during alterations.—*Cymri*, Vol. XX., pp. 188-191.

corner to the North-West Gate, and 100 ft. in width. The remains of the various buildings uncovered in this process were described in Mr. James's report, which appeared several weeks later. The results of these trial trenches were most promising, proving beyond question the desirability of a complete exploration of the fort.

During the following winter, the Archæological Section was revived, with Mr. J. Stuart Corbett as President, and Mr. George E. Halliday, F.R.I.B.A., as Honorary Secretary, and to this section was committed the exploration. Mr. Hanbury Leigh kindly renewed his permission, and arrangements were made with the tenant for the sub-letting of the field to the Society. It was felt that the undertaking would be costly, altogether beyond the means at the disposal of the Society, but it was also felt that the results would be of such general interest as to justify an appeal for outside help. The chief aim of the search was to disclose the plan and construction of the fort, as it could hardly be expected that the "finds" from a purely military site would be as many and varied as those from a villa or a city; whereas a complete and reliable plan would be a decided gain to archæological knowledge. The first operations were to be the opening out of the south-west and south-east gates, and the exploration of the whole space between the *Via Principalis* and the north-west rampart. The surface-indications of buildings in this region being extremely vague, the method proposed was diagonal trenching, the trenches to be 2 ft. wide and 8 ft. apart. The question of supervision was a difficult one, as no member of the Section could afford the time this would involve; it was, therefore, arranged that the names of the members of the Sectional Committee with the addition of those of a few other gentlemen interested in the work, should be entered upon a *rota*, each so entered being responsible for a week to make as many visits as possible to the excavations and to direct the men. Mr. Seaborne undertook to engage the men and to act as paymaster; and Mr. Rodger, to make the survey, as before.

On May 14th, 1900, I commenced the operations on the spot by the excavation of the South-West Gate. This was completed

by my successor on the *rota*, who took in hand the South-East Gate; and then followed, a week or so later, the diagonal trenching of the space just referred to.

A few words upon archæological spade-work may be acceptable at this point. When, as sometimes happens, the foundations of buildings stand out as ridges or are marked by a discoloration of the herbage, all that *may* be necessary is to simply follow up the indications with the spade, laying bare the masonry as we proceed. But when the surface-indications are slight and uncertain, the procedure has to be modified. The first step is to gain an idea of the character and extent of the buildings, and the best way to obtain this is to drive a diagonal trench across the site—I assume, of course, that the orientation of the buildings is sufficiently evident to admit of the laying down of a diagonal. The advantage of a trench of this sort over one that runs parallel with one set or other of the walls, is, that it ensures the discovery of a larger number of buildings or rooms. The diagonal trench, having brought to light sundry walls, we next proceed to follow these up as described above. This is an excellent method of excavating a villa, for the rooms and buildings on such a site being usually connected, the excavation of one leads on naturally to that of another, until the whole plan is disclosed.

In either of the above methods, the exploration will be only complete so far as the walls are concerned. In order to ascertain what the different apartments contain, it will be necessary to cut a trench or two across each. This should always be done even in small rooms, for it is impossible to say without the aid of the spade, what may not lurk beneath the turf. But it need hardly be said that the only way to make a site yield up *all* its secrets, is to wholly remove the accumulations of *débris* and mould which cover it. This is costly, not merely on account of the large amount of digging, but on account of the distance the throw-out has to be removed so as to keep the site clear. It is, however, often necessary to adopt this extreme measure, and it is the only way of making the lay-out and character of a buried building intelligible at a glance.

When it is necessary to obtain the plan of such an area as the insula of a city or this space between the *Via Principalis*

and the north-east rampart at Gellygaer, and we are uncertain what buildings it may contain or how they are distributed, we must resort to some system of trenching which will prove the *absence* as well as the presence of buildings. The most efficient and economic way of doing this is by a series of parallel diagonals, provided they are sufficiently near to one another. Set out at an angle of 45° , and 8 ft. apart, as at Gellygaer, a building to escape detection will have to be *less* than 5 ft. 8 in. square, so that we may assume that if no walls are struck in the diagonals, there are no buildings on the site. Another advantage of the system is that the throw-out is well distributed, and consequently is easily replaced. There is always a risk that the spots on which great spoil-heaps are raised, may have to be subsequently excavated.

The character of the site can be learned from the glimpses afforded by these trenches. Usually this will be sufficient, especially in the case of floors and roads; but where it is necessary to prove the continuity of walls, it will be an easy matter to remove the soil from their summits.

To return to the course of the Gellygaer exploration. During the months of June and July the work did not proceed as satisfactorily as could be wished, and the chief cause of this was the *rota*. It is one thing to have a willing heart and to be on a *rota* for a certain week, but it is another to find one's self free to act when the time comes. Business calls are not usually respecters of days. It is not surprising, therefore, that some, whose names were on that document, failed to put in more than half a day during their week. I have no doubt that they could, and willingly would, have given a helping hand at other times had their co-operation not been limited to a particular week. It is not an easy task for anyone who has not followed an excavation, to gather from the confusing web of trenches and spoil-heaps, the significance of the discoveries, yet this he must do, before he can be in a position to advise as to the next step. Nor has he much incentive for thoroughness, seeing that he will drop out at the end of his week, and his successor may reverse his procedure. Another fault of these earlier days was the insufficiency of labourers. We began with two, then the number oscillated between three and four until August 20th,

when for five or six weeks from twelve to fourteen were employed. Eight or nine labourers in continuous employment from the first would, I think, have given better results.

It is well to keep our mistakes in mind so that they can be avoided in the future. My opinion is that it would have been better to have excavated the site in sections corresponding as nearly as possible with the several buildings, and to have arranged that each section should be under the supervision of *one* person from first to last, who would also draw up full notes upon his portion. Not that he should necessarily be on the spot daily—he could seek the assistance of colleagues—but he would be responsible to see the excavation of his section through, and it is reasonable to think that he would aim to excel in the economy and thoroughness of his work and the completeness of his notes. Before each section was finished, it would fall upon someone—the Secretary, presumably—to organize the work of the next section.

Towards the end of July the Gellygaer exploration received a strong impulse. Mr. William Riley, J.P., one of the Vice-Presidents of the Section, set, at his own expense, a gang of nine men to excavate the ramparts, the four men in the employ of the Society continuing to work upon the interior of the fort. These men were under continuous supervision, the Rector, and for a week or two, Mr. Edwin Seward, F.R.I.B.A., acting for Mr. Riley in his absence. Soon the spade revealed the interesting fact that the ramparts had twelve tower-like structures, in addition to the gates. Towards the end of August, the number of men* in the employ of the Section was raised as stated above in order that the work of exploration might be finished during the autumn, but later it became evident that it could not be accomplished in the time. Arrangements were, therefore, made with Mr. Edwards for the retention of the field another year, and the more exposed walls were covered with turf to protect them from the frosts of the coming winter.

The work was resumed on June 3rd, 1901, and was carried

* An excellent photograph of these men is reproduced in *Cymri*, Vol. XX., p. 268. In the front row, with his dog, is the foreman, William Jones, a sturdy Welshman, who stuck to the work from first to last, entered fully into its spirit, and became quite an expert archaeological digger. In the next volume, p. 69, is reproduced a photograph of the field at this time.

on with five, and sometimes six, men until late in August. As the important central buildings had been only partly uncovered in the preceding season, they received the first attention, Mr. Riley and the Rector superintending. These completed, all the men were dismissed except two, who were placed at my disposal for several weeks to make any supplementary investigations which might be required for the drawing up of this Memoir. I venture to suggest that in our next "Gellygaer" the editorship should be settled from the outset, for the editor should follow the excavations as they proceed, as then is afforded the best opportunity for observation and inference. Few notes had been made during the later diggings of 1900 and those of the following summer, and as I had rarely visited the place during these periods, I had to make my examinations under unfavourable conditions, all the trenches of the former year being overgrown with weeds, and often half-filled with soil. This further shows the desirability of carrying out an undertaking like this of Gellygaer in sections, full notes on each section being made while its excavations are fresh.

We now come to the last phase of the work, the refilling of the excavations. After much consideration, the Committee came to the conclusion—undoubtedly a wise one—that this should be done by contract. The tender of Mr. W. Symonds, of Cardiff, was accepted, and Mr. Rodger made all arrangements for the carrying out of the work, a task which proved to be no light one. By the end of the year the trenches were all filled in and the field was handed back to Mr. Edwards.

The total cost of the work on the spot incurred by the Society (that is excluding the portion generously defrayed by Mr. Riley) has been £402 13s. 7d. The total amount received from various contributions to meet this has been £309 2s. 6d., leaving a deficit of £93 11s. 1d. to be made good. A full list of contributions is appended at the end of this Memoir.*

* The Rector has contributed to *Cymri* (Vol. XX., *et seq.*) a series of articles on the history of Gellygaer, in the course of which he describes the Roman remains and the exploration. References to the progress of the exploration have appeared in the *Athenæum*, the *Times*, the *Antiquary*, *Archæologia Cambrensis*, the *Western Mail*, and the *South Wales Daily News*; and a short report upon the results of the work will appear in the next volume of the *British Association Reports*.

SECTION IV.

A General Survey of the Fort.

Plan.—The first thing that will strike the reader on looking at Mr. Rodger's plan is its obvious completeness.* Every portion of the site is accounted for. There is no room for an undiscovered building. It is true that a few portions of the plan—mostly on the rampart—have been conjecturally filled in. These represent places which could not be excavated in consequence of trees, of the cottage and garden at the south corner, and of the Rectory fence on the north; but fortunately there are corresponding parts which have been excavated, and so supply us with *data*. The ditch was the least investigated member, but there is no reason to doubt that it passed all round the fort as indicated, and that it was of the same character throughout.

Another feature of the plan is its simplicity. If any inference may be drawn from this, it is that such a plan is more likely to express a Roman fort reduced to its essential elements, than a complicated one like that of Housesteads or Chesters. Its value in this respect is enhanced by the fact that our fort has all the signs of being of one design and execution. The only apparent exception to this is the double set of cross-walls in Block VIII.; but I hope later to show that this does not imply a succession of two buildings on the site.

The reader will not fail to observe the general bilateral symmetry of the plan, the right and left balancing of parts. In these respects, as also in the position of the four gates and the lay-out of the streets and buildings, he will note a general

* The Ordnance Survey Office published a plan of the fort (Sheet xx. 9, Glamorgan, 888). Owing to the circumstance that that survey was made in February, 1901, that is, before the completion of the exploration, there are points of difference between it and Mr. Rodger's. In order to avoid any question that might arise in the future as to which plan should be accepted as correct, a sub-committee, consisting of Messrs. Drane, Riley, and the writer, visited the site with both plans, and as a result of their investigations, Mr. Rodger's was confirmed.

likeness to the camps of Polybius and Hyginus. If he pursue the comparisons further, he will see in the rounded corners, the narrow *intervallum* and the forward position of the *Via Principalis*, Hyginian traits, while the approximate squareness of both the fort as a whole and the central *Pratorium* will appeal to him as Polybian legacies. And he will feel assured in these surmises when he notes the intermediate age of our fort, for when it was erected, Polybius had been gathered to his fathers some centuries, while the author of the tract attributed to Hyginus was probably not yet born.

The array of tower-like structures at regular distances apart will particularly recall Josephus's vivid description of a Roman camp. So exactly do his words tally with the remains of our fort that we might suppose him to be describing Gellygaer in its palmy days, with the important difference that he had in mind a *temporary* camp, whereas Gellygaer was a *permanent* one. But is it not significant of Roman inflexibility that the description of a camp at the far east of the Empire should so exactly apply to a post amid the hills of its western fringe?

Two further marks of intermediateness may be noticed. The three well-defined segments—the *Pratentura*, the *Retentura*, with the intervening *Pratorium* and its *latera*—of the Hyginian camp, are not clearly marked at Gellygaer. There is, it is true, no difficulty about the first segment, since it is divided from the rest of the area by the wide *Via Principalis*; but as there is no continuous thoroughfare at the back of the *Pratorium*, answering to the *Via Quintana* of Hyginus, the other two segments are somewhat merged into one another. If on the other hand we identify this *Via* with the well-defined thoroughfare midway between the *Pratorium* and the South-West Gate, the *Retentura* is reduced to a mere strip containing two buildings (I. and II.). In this respect Gellygaer contrasts with some of the Northern forts, which being probably of later erection should presumably have more strongly marked Hyginian affinities. At Housesteads, for example, the *Pratentura* and *Retentura* are of equal size, while at Birrens, the latter actually exceeds the former.*

* For some interesting remarks comparing the forts with the Hyginian camp, by Mr. Haverfield, see the Appendix.

Next, the system of measurements at Gellygaer appears to agree with Polybius rather than Hyginus. The former, in common with the older Roman land-measureurs, followed the decimal system, and made use of ten-foot staves (*decempeda*),

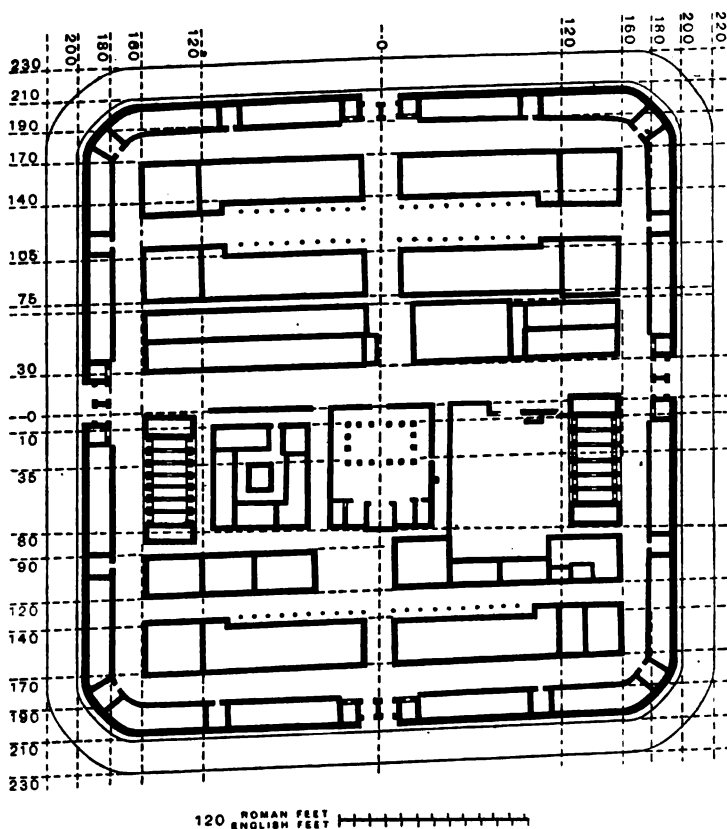


FIG. 2. PLAN OF THE GELLYGAER FORT, WITH CHIEF ALIGNMENTS IN ROMAN FEET.

whereas the later men preferred the duo-decimal system.* It is tolerably clear that the constructors of Gellygaer used a ten-foot staff, for the buildings are usually in multiples of that length, and frequently its half, 5 ft., occurs as a fraction (Roman

* So Smith's *Dictionary of Greek and Roman Antiquities*, article "Castrum."

feet, of course). This may not be apparent at the first essay, for (1st) the fort was evidently not laid out with equal precision throughout, and (2nd) the deviation from exact measurements is often found to amount to the width of a wall. The latter is not necessarily due to negligence; nevertheless, the placing of a wall on the wrong side of a line is a mistake easily made.

If the general plan be again consulted, it will be observed that the fort as a whole is slightly oblique; that is, its outline would be more exactly described as a parallelogram than an oblong. There is no reason to think that this departure from right-angledness is intentional, in fact it is so slight that it would not be noticed on the spot, and probably the builders were not conscious of it. It is undoubtedly due to a faulty setting out of the work at the start; and the same defect may be seen in some other Roman forts, Cardiff Castle for one.

Treating this obliquity as accidental, the Gellygaer fort may be described as a short oblong. Its length, reckoned from the outer face of the rampart, is 404 ft., and breadth 385 ft. (or about 415 and 395 Roman feet respectively), so that it is one of the smaller of the excavated series. These measurements are along the *cardo maximus* and the *decumanus maximus*; if taken along the sides they vary slightly, the two longer sides being 400 and 402 ft., and the two shorter, 384 and 386 ft. It will be noticed that the length exceeds the breadth by only 20 Roman ft., a degree of shortness unusual in the British series, many of which are from a quarter to a third longer than broad.

Another peculiarity is the backward position of the *Via Principalis*, and consequently of the *Prætorium*. In all our excavated forts this road occupies a position nearer the front than the back.* In some, like Great Chesters, Lyne, and Housesteads, it is approximately distant from the front one-third of the whole length, but in most, the distance is greater. At Gellygaer, however, the S.W. or *Prætorium* side of the road is practically midway between the front and the back, a peculiarity only shared by Melandra Castle.

This is interesting, for the "groma," an instrument used in the setting out of lines at right angles with one another, from

* For these words as here used, see footnote, page 3.

which the various measurements were made, is shown in the middle of that side of the *Via* on plans of the Hyginian camp, as that given in Smith's *Dictionary of Greek and Roman Antiquities*, for instance. The actual centre of the fort is a spot in the middle of the entrance to the *Prætorium* on its inner side. That *that* may have been the very spot where the "groma" was set up is not unlikely, for from it the chief blocks of buildings may be measured off in multiples of the *decempeda* and its half. The foregoing plan (Fig. 2) will show at a glance how remarkably the various buildings fall in with the decimal measurements; the correspondence is surely too close to be accidental.

The length of the Roman foot is variously given as 11.65 and 11.66 English inches, the difference between these limits being only the thickness of an ordinary visiting card. The mean of a large number of Gellygaer measurements implies a foot of 11.652 English inches.

Materials and Construction.—The walls of the buildings rarely remained to a greater height than 3 ft. above the Roman level, but in spite of the vicissitudes of seventeen or eighteen centuries, these surviving portions were, as a rule, in tolerably good preservation. Even where they were obliterated, the firm foundations remained and were easily traced, so that it rarely happened that there was any uncertainty as to the plan of a building. The building material was almost wholly the local pennant-grit which is still the chief building stone of the district. This rock is a hard silicious sandstone of a dark blue-grey hue when first quarried, but soon weathering to a brownish grey, thinly bedded, sometimes so much so as to admit of its extensive use for roofing purposes; and of remarkable lasting qualities.

The masonry of the fort may be described as rubble work, more or less coursed, but varying considerably in quality. The pilasters and sides of the gates, for instance, were faced with well-selected stones, mostly squared, and laid in definite courses. The dressing was, as a rule, accomplished by the hammer, the use of the punch being limited to the removal of projections or "rough rock," which would not answer readily to the hammer. These dressed surfaces varied, being "sparrow-pecked" here,



MASONRY AT THE NORTH-EAST GATE.



Miss Neale.]

WELL IN THE PRÆTORIUM.

and "batted" there, the "bats" having occasionally a zig-zag arrangement. Miss Neale's photograph of some of the masonry of the North-East Gate (Plate II.) gives a good idea of the general appearance of the better-class work; and in Fig. 3 is mapped, so to speak, the distribution and varieties of dressing on a portion of that of the South-West Gate. The courses varied from 3 to 5 or 6 ins. in height. Nothing of the nature of a mason's mark was noticed.

What has been said of the masonry of the gates will apply, in some degree at least, to those portions of the exterior walls

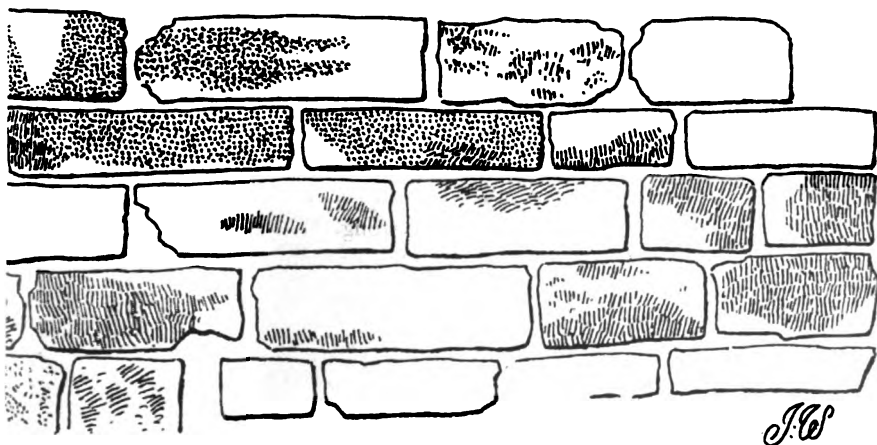


FIG. 3. MASONRY AT THE SOUTH-WEST GATE. ($\frac{1}{12}$).

of the buildings within the fort, which stood above the level of the streets. But the interior walls and the work below the ground-level or otherwise out of sight, were built of rough rubble, sometimes with an admixture of weathered field-stones.

The joints were wide. The mortar was almost everywhere reduced to a fine sandy loam of the same colour as the surrounding soil, through the removal of the lime by solution. Where least changed it retained considerable hardness, but it was doubtful whether the hardness was ever great. Mr. W. Clarke considers that the lime used was "white lime," made from carboniferous limestone, and his experience of ancient buildings

has shown that this lime has not the lasting qualities of that made from lias limestone. This is well illustrated in the Roman mortar and grout at Cardiff Castle, which are made of the latter lime, and are still of singular hardness. The nearest locality where the requisite limestone occurs is the vicinity of Castell Morlais, ten miles to the N.W., near which the Heol Adam, or rather its continuation, passes. There was no sign of the use of grout at Gellygaer.

The only other stone which undoubtedly entered into the construction of the fort, was a calcareous tufa, used for the voussoirs of the gate-way arches. There is little doubt that it came from the above district. The late Mr. G. T. Clarke noted its use in some vaulting at Castell Morlais (*Medieval Military Architecture in Great Britain*, Vol. II., p. 313), and suggested that it was derived from a thick deposit of this substance near Pont Sticill.* One of the blocks from Gellygaer exhibits a saw groove. On the site of Building VIII. several large squared blocks of a soft sandstone were met with, but there was no proof that they had been used for building purposes.

The foundations of all the outside, and of most of the divisional, walls were deep and strong. The builders' *modus operandi* was to cut a trench a foot or more wider than the intended wall, and from 1 ft. 6 ins. to 2 ft. deep. In this they placed rough stones either in courses or packed on end like a rude pitching, the former method being the more usual for the larger walls. On the summit of these, and somewhat below the then ground-level, they planted their wall, with or without the intervention of a footing. The simpler sort of footing consisted of a single course of stones, usually thinner and larger than the average, and projecting to form a set-off on one or both sides of the wall. In other cases, it consisted of several courses with one or more set-offs. The exceptions to this form of foundation were very few, the most notable being those of the internal walls of the *Pratorium*. Here, the footings rested upon the old natural surface which appeared to have been beaten hard for the purpose.

* Since this was written, many pieces of this substance have been found on the site of a Roman building in Pen-y-darren Park, Merthyr Tydfil, and they appear to be portions of voussoirs, and of supports for flue tiles.

Bricks entered into the construction of the walls of two buildings, which will be described on pages 68 and 69. On several spots, numbers of loose bricks of various shapes—square and half-round, flat bricks and voussoirs—were found under circumstances which led me to think that they had not been used in the construction of the fort. They appeared to have been

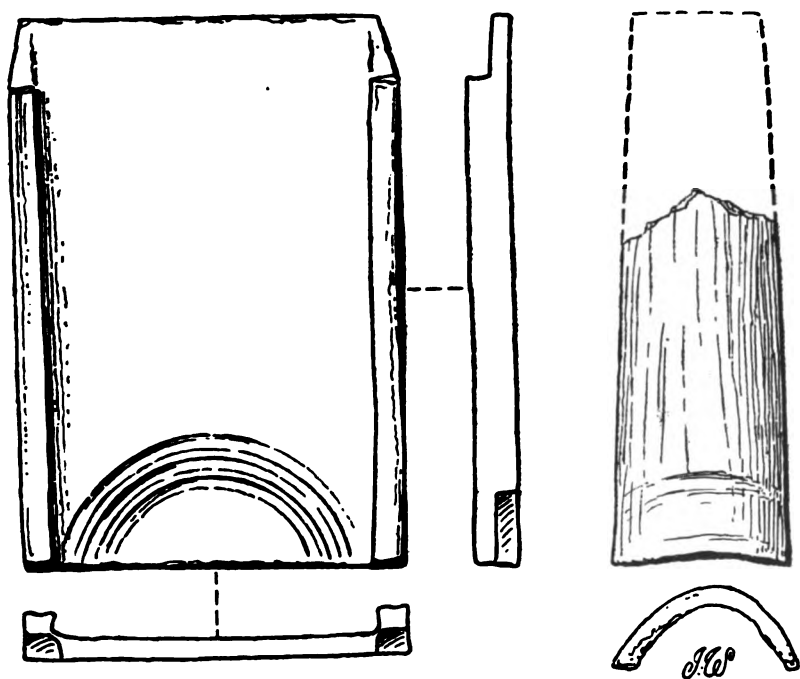


FIG. 4. ROOFING TILES: *Tegula* AND *Imbrex*. ($\frac{1}{8}$).

intended to break up for brick-concrete or *opus signinum*, several heaps of broken brick and tile suitable for this purpose having been met with in the course of the exploration.

Roofing-tiles were found on the sites of certain of the buildings, notably the *Pratorium* and its "latera," under circumstances which showed that they had fallen from roofs above. They were of the usual Roman type (Fig. 4)—flat flanged *tegula*,

1 ft. 11 ins. by 1 ft. 4 ins, and the half-round *imbrices* to cover the joints between the former. How these were combined is shown in the next drawing (Fig. 5). As these tiles had no nail holes, it is evident they were used for low-pitched roofs, where they would keep in place by their own dead weight. From the

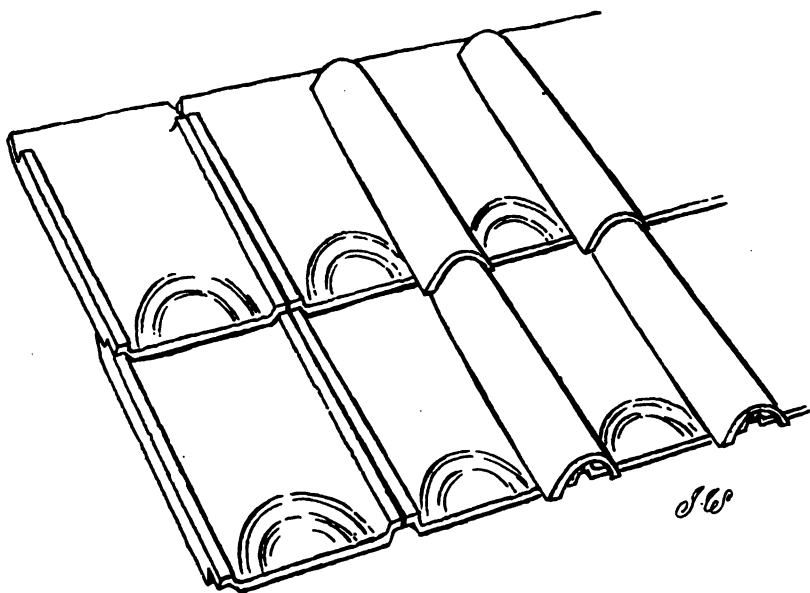


FIG. 5. ROOF OF *Tegula* AND *Imbrices*.

occasional traces of mortar on the flanges and inside the *imbrices*, it would seem that when the *tegulae* were arranged on the roof, the joints were capped with mortar, and the *imbrices* pressed into position. Two, if not three, different makes of these tiles were distinguished by slight differences in shape, texture, and colour.

Several small tiles (Fig. 6), made from broken *tegulae*, and with "knocked-out" nail holes, were found. These are regarded by Mr. Clarke as valley-tiles.

As no roofing-tiles of any sort were found on the sites of many of the buildings, we may conclude that these were either thatched or covered with wood.

It is curious, that in a district so rich in suitable stone for roofing purposes, not a single stone roofing-flag was found on the site. This is all the more remarkable, as such flags have been abundantly found among Roman remains at Caerwent, Llantwit Major, and Ely Race-course, Cardiff.

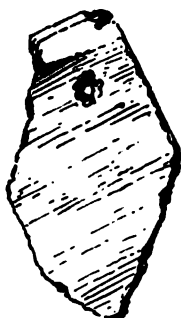


FIG. 6. VALLEY-TILE. ($\frac{1}{2}$).

The floors of the different buildings were singularly indeterminate. In several, a little pennant gravel or fine rubble suggested concrete, or a fine loamy sand, mortar, both denuded of their lime; in others, the natural soil seemed to have been rammed or "punned," or even hardened by fire; more than once, patches of paving of small flat stones were met with, but, with few exceptions, nothing in the form of a prepared floor was found. In describing Buildings V., VI., and VIII., I shall give reasons for thinking that their floors were of wood.

No trace of wall-plaster, plain or coloured, was found. In Buildings V. and VIII. there were many fallen pieces of brick-concrete, which will be described later. In the latter building I picked up some coarse stucco, with which had been mixed chippings and shavings of wood. The wood, of course, had disappeared, but the impression of the grain was left. Some of it, at least, was oak.

Window-glass.—The broken window-glass, of which a considerable amount was found, is evidence that some, at least, of

the windows had glazed windows. It was of the usual type, dull on one side, of a blue-green hue, from $\frac{1}{8}$ to $\frac{1}{2}$ in. in thickness, and many pieces exhibited the rounded edge of the melted cake. Unfortunately no record was kept of its distribution; but the Rector, whose almost daily presence on the spot gave him excellent opportunities for observation, writes as follows:—"Window-glass was found especially on the site of Block VI. It was also found in the unpillared portion of the *Pratorium*, and generally near the L-shaped buildings I., II., XII., XIII., XIV., and XV. There was a marked absence of it from the gates and the towers, also from the 'buttressed' buildings V. and VIII."

Roads and Drains.—The roads of the fort were only trenched in two or three places with the set purpose of discovering their form and structure, but they were incidentally touched at other points; the various exposures, however, sufficiently proved that their materials and construction were tolerably uniform. The best section obtained was on the S.E. side, about midway between the gate and the east corner (Plate IX.). Here, the compact surface of the road, smoothed by wear, and apparently as sound as on the day the last Roman foot trod it, was found at a depth of about 17 ins. below the turf. Its upper part consisted of several inches of broken pennant, the pieces varying as a rule from $1\frac{1}{2}$ to 3 ins. across. This rested upon a foundation of larger stones, mostly from 5 to 7 ins. across, which gave place below to still larger and rougher stones. These stones appeared to have been freshly quarried, and were piled up horizontally, the lowest resting directly on the old natural surface. Although these different grades of material did not show out as well-defined layers, there was no doubt that they had been deposited as such. The total thickness of the road here was about 2 ft., of which one-half was taken up with the larger stones of the foundation. Along the inner edge of the road—the edge towards the interior of the fort—the foundation had a kerbing of large stones built up in two or more courses, which served also as the side of a drain. The opposite edge of the road had probably a similar kerbing, but was not excavated.

The excellent preservation of the road at this point was obviously due to the considerable thickness of soil, derived from the rampart that covered it. The roads nearer the centre were rarely covered with more than 9 or 10 ins., consequently were in a disturbed condition. Usually the superficial metal of broken stone or gravel—for occasionally water-worn pennant pebbles from some local stream had been used—was very sparse, merely filling the spaces between the upper stones of the foundation, the tops of which were often worn by traffic.

The roads varied much in thickness. In several places they consisted of a little broken stone on a single spread of larger stones, the whole scarcely exceeding 6 ins. This variation in the thickness was owing to the irregularities of the old surface, the constructors filling up the hollows, so that their roads might be as level as possible. The great thickness of foundations observed in the cutting described above was evidently with a view to counteract the sharp natural declivity on that side of the fort.

In the space in front of the *Pratorium*, and still more so along the further side of the yard next to it, were remains of rude paving.

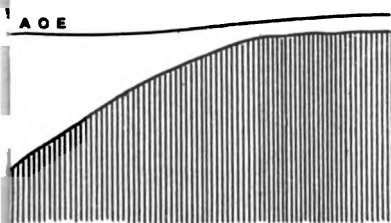
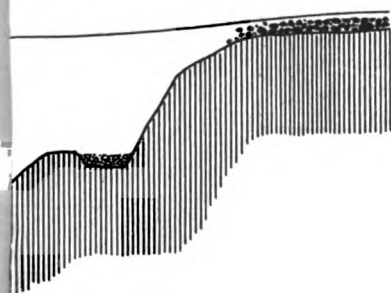
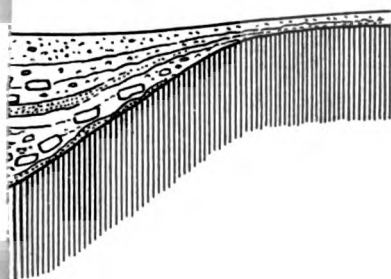
The site of the road which passed through the South-West Gate was trenched midway between the gate and the present highway, when the foundation (with traces of gravel), about 28 ft. across, was exposed.

The drains were not as fully traced as they might have been, but more so, probably, than in other excavated Roman forts. Those which were found, were of like construction, but varied in size. With one exception, the sides were walled, but when the drain ran along the margin of a road, the foundations of the adjoining buildings were frequently utilized to form one side, and in the case of small drains in similar positions, the road-kerb formed the other, an arrangement which has been noticed in some other Roman forts. In the exception just referred to, the sides were formed of flags set on edge. They all appeared to have been roofed with horizontal slabs, but more often than not these had been removed. There were clear indications that these slabs had been covered with from 4 to 8 ins. of

road-metal. With several exceptions, the bottom consisted of the natural soil, hard as though beaten.

One of the main drains ran along the S.W. side of the *Via Principalis*, and for portions of its length, the foundations—carefully built for the purpose—of the adjoining buildings formed one side. It was best preserved at its northern or upper end, where its width was 1 ft. 10 ins., and height 2 ft. 4 ins., and its bottom neatly pitched; this being the only place where definite pitching was observed in a drain. Towards the opposite or lower extremity, it was also in fair condition, but the “push” of the soil had considerably reduced its width, the height being the same. The middle portion was, as a rule, in a ruinous condition, and nowhere were the cover-stones remaining. It passed through the left passage of the South-East Gate, and doubtless terminated in the ditch outside, after the manner of that which passed through the South-West Gate.

Several minor drains fell into this main drain. At its head a small prolongation pointed towards the left portal of the North-West Gate, but its termination could not be traced; probably it drained the road at the gate. In the vicinity of the *Prætorium* three others joined it: one, much tumbled about, being traced a short distance between this building and Block VI.; another drained a tank or cistern in the open space before its entrance; and the third passed along the narrow way between it and the yard to the S.E. The last drain was remarkably well constructed, 10 ins. wide and 8 ins. or 9 ins. deep, with a neatly flagged bottom, built sides, and large covering slabs—some, 6 ft. or 7 ft. long—mostly remaining. It extended at least two-thirds the length of the lane, and received two branches from the *Prætorium*, the one from its courtyard, and the other from a small sink in one of its rooms. About 60 ft. from the South-East Gate, the outlet (with flagged sides) of the latrine in the east corner of the yard, fell into this main drain; and just before entering the gate, it received the roadside drain already referred to on page 30, which consisted simply of the space between the kerb and the foundations of the buildings, from 1 ft. to 1 ft. 2 ins. wide, and originally covered with slabs. On the opposite side of the main drain at the South-East Gate, there



A O E

DITCH III.

J. Ward, Mens. et Del.



was the opening of another, pointing towards the south corner, but it was not traced.

We must now trace the course of the large drain which debouched at the South-West Gate. The excavations showed exactly how it opened into the ditch (Plates III. and IV.). After passing through the right passage of the gate, it made an outward bend at the corner of the adjacent guard-chamber, so as to escape the abutment of the bridge. The construction here was as elsewhere, but the bottom was roughly paved or pitched. For a short distance behind the gate it was not excavated, but beyond this its whole length was opened out. It veered to the left by two bends, keeping to the roads in so doing, and at length entered, by a curve, into Building VI. For the last 100 ft. it was in excellent preservation, with most of the cover-stones remaining. Towards the end it increased in size, attaining a width and height of about 2 ft., the sides being constructed of five courses of rough quarried stones. The drain had throughout a gentle fall of about 1 in 65. The only indication of a branch drain was at the bend next the gate, and this probably drained the road between Blocks I. and III.

There was no evidence that drains passed through the other two—the North-East and the North-West—Gates; but in the former case, no thorough search was made, and in the latter, the presence of one was not to be expected, the ground there being the highest in the fort.

It will be observed that this account of the drainage of the fort leaves unnoticed many of the roads, which were either not searched for drains, or if searched, the drains were probably in too ruinous a condition to be recognized as such.

SECTION V.

The Fortifications.

The Ditch.—The ditch was excavated in two places; the one on the S.W. side near the west corner, in 1899, and the other, in front of the South-West Gate, in 1901 (Plate III., sections I. and III.). In both of these cuttings the filling was readily distinguished from the undisturbed natural soil, so that the form and dimensions could be easily made out. It was of the usual Roman form—V-shaped, approximately 19 ft. wide on the old-surface-level, and about 7 ft. in depth. The two sections slightly differed, the one being strictly a “V,” that is, pointed below, while the other was channelled out into a rounded bottom. The former may be accepted as the normal form, for the latter was near the outlet of a drain, and its rounded bottom may have been due to the scour of water therefrom.

The filling of the ditch at these points consisted, first, of a variable amount of silt-like loam covering the sides and attaining to a thickness of 6 in. or more in places. This was of the same colour as the natural soil, but was more gritty and less tenacious, and it contained fragments of charcoal, brick, and pottery. It was undoubtedly rain-wash derived from the surface and the upper parts of the ditch.

Above this, and chiefly on the inner side, was much fallen *débris* from the outer wall of the rampart, which contained many squared and dressed facing-stones. The effect of this *débris* has been to throw the lowest part of the present surface several feet forward of the central line of the original ditch. At a higher level the *débris* was finer, and above all was a layer of dark surface-mould varying from about 8 ins. to half-a-yard in thickness.

No attempt was made to ascertain whether the ditch ran concentrically with the rounded corners of the rampart, but to

judge from the contour of the ground at the west corner, it is probable that it did so.

The modifications in the form of the ditch to receive the abutments of the bridge at the South-West Gate, will be considered under "The Gates."

The Rampart.—Wherever the rampart was excavated, it was found to be of earth faced with masonry on both sides, and set back from the inner lip of the ditch about 5 ft., evidently with a view to secure the stability of the outer wall. Its width varied from 19 ft. 4 ins. to 20 ft. 2 ins., but was usually a trifle under 20 ft. The variation was due to irregularities in the line of the inner wall, which was erected subsequently to, and in lengths stretching between, the gate-chambers and the towers. The builders of these lengths were guided by the backs of these chambers and towers, but as these structures varied in depth, their work varied accordingly. These irregularities, therefore, were not intentional, the original design being apparently a rampart of 20 Roman feet in width. The earth was evidently derived from the ditch and the foundation trenches of the retaining walls.

The outer wall, where it was brought to light, varied from 3 ft. to 4 ft. 3 ins. in thickness, the latter thickness being attained on the N.E. side. The stones used in its construction were well selected, and were larger than those used in the other buildings. The face was straight, vertical, and well built, most of the facing-stones being dressed to a greater or lesser degree. The back was extremely irregular, and from its general appearance Mr. Clarke, who has much experience of ancient masonry, concluded that the wall had been built *against* the earthwork,* a conclusion that I quite concur in. It was noticeable that many of the stones used in the core and back were

* This is of some importance, as will be seen on a later page. It would be a difficult task to adequately describe the indications from which Mr. Clarke drew his conclusions. It may, however, be mentioned that the chief of these was the manner in which many of the stones at the back were placed, clearly implying that they had lodged against something immediately behind the wall. The masons, beginning at the front, laid their stones flat until they almost reached that *something*, when they packed in the stones anyhow to suit the intervening space. ♣

weathered, as though they had been collected from the surface instead of being quarried. On the N.W. and N.E. sides, towards the north-corner, this wall rested upon a projecting foot-course or set-off of rough flag-stones; but on the S.W. side there was apparently no foot-course. The foundation, where examined, consisted of large rough stones laid in courses in a trench from 1 ft. 6 ins. to 2 ft. in depth.

The earth-bank in its present state has a convex summit varying from 2 ft. 9 ins. to 3 ft. or more in height above the old natural surface. In the cutting near the west corner (Plate III., Section I.) a complete section was presented. It there consisted of the ordinary soil of the site, free from vegetable mould, charcoal, potsherds, &c., and was extremely compact, as though it had been beaten. Between it and the undisturbed natural surface was a thin seam of fine loam, which may have replaced the old vegetation in the process of decay. Similar films were noticed elsewhere in the diggings. The bank was cut into in various other places, and in each the same clean soil was observed; but in one place on the N.E. side, the outer 5 ft. consisted of a sharply marked-off dark mould, and near the South-West Gate there was a similar dark mould. These may imply nothing more than that the diggers of the ditch found it convenient to stack turf on these spots.

The inner wall arose from a similar foundation to that of the outer, but it was thinner and of rougher construction. Neither wall remained to a greater height than 2 ft., but up to that height their faces were vertical.

The original height of the rampart is an interesting question, but as might be expected, the excavations supplied no direct answer. It is possible, however, to form some idea from a calculation of the cubic contents of the ditch and the foundation trenches of the retaining-walls and other structures of the rampart, *assuming*, of course, that the earth-bank was *wholly* formed of the throw-out from these. Taking the dimensions of the ditch, as given above, to be constant throughout its circuit—and there is no reason to doubt this—each 1 ft. run would provide some 66 cubic ft. of soil, and we shall not be far wrong if we estimate the removed soil of corresponding lengths of the

foundation trenches of the two retaining-walls as 7 and 5 cubic feet, respectively. Then besides these, there were forty-four cross-walls, forming the sides of the towers and the gate-chambers, and the *spina* of the gates. These were of various thicknesses, but we may set down the average throw-out from each foot of their foundation-trenches as 4 cubic feet. These data give us the following totals of cubic feet of removed material available for the rampart:—

		Length.		Removed soil.
Ditch	...	1,650 ft.	...	108,900 cb. ft.
Outer Wall	...	1,440 ft.	...	10,080 cb. ft.
Inner Wall	...	984 ft.	...	4,920 cb. ft.
Cross Walls	...	572 ft.	...	2,288 cb. ft.

126,188 cb. ft.

The average width of the earthen portion of the rampart, that is, of the space between the two retaining-walls, may be put down as 14 ft. It was discontinued not only at the gates, but at the towers, so that its length was not more than 1,020 ft. Here, then, we have an area of 1,020 ft. by 14 ft. over which to distribute the above 126,188 cubic feet of soil. A little calculation will show that this soil would form a bank with vertical sides and a level top, about 9 ft. in height. It is not likely that this was the form at Gellygaer, for the inner wall—quite an exceptional feature—being of slighter build than the outer, was not so well adapted to withstand a thrust. On the other hand, the earth, as in some other Roman forts, would probably be heaped against the outer wall, so as to have a narrow flat summit to serve as a rampart-walk, and a back-slope towards the ground, the inner wall simply retaining the foot of the slope. If we so distribute the contents of our hypothetical bank as to take the form just described, its height will be 11 ft. or more, instead of 9 ft. Above this level the outer wall would have to be raised to a sufficient height—say, to 15 ft.—to serve also as a parapet.

A bank of the height of 11 or 12 ft. would have the advantage of providing a rampart-walk sufficiently elevated to pass over the arches of the gates, and thus be continuous round the fort upon a common level. It has been questioned whether the outer

wall was thick enough to withstand the pressure of a bank of these dimensions. Most of the architects, however, whom I have consulted, have expressed the opinion that, taking into consideration the form of the bank and the stiffness of its soil, the wall would be sufficiently thick for the purpose. It has been suggested that some of the throw-out of the ditch and the foundation trenches of the rampart and its appendages was used for a glacis,* or was spread over the interior of the fort; but nothing was observed during the exploration to warrant either supposition. It may be asked: If so high a bank, where has its material gone to? Much of it has undoubtedly rolled back into the ditch, and the considerable thickness of soil which overlies the surface of the *intervallum* is proof that much has rolled in an opposite direction. If these were replaced upon the portion remaining *in situ*, their united volume would not be much short of our hypothetical bank.†

* I made special search for the traces of a glacis on the S.W. side of the fort in 1899 and 1901, but failed to detect any.

† Mr. Haverfield's comments upon the above will be read with interest: "I know no precise parallel to the stone facing and earthen core of the walls at Gellygaer. Their origin is, however, not obscure. The ramparts of forts in the early Empire were generally earthen; in the third century they were generally of stone. The exact history of the transition is not yet ascertained, but it is probable that earthen ramparts continued to be constructed down to *circa* A.D. 140, and that stone ramparts began to be common after A.D. 100. The German Limes excavations have shewn that on the Rhino-Danubian frontier the earliest forts were walled with earth and the later with stone. Arrian records that about A.D. 135 he found a fort on the Armenian frontier, at the mouth of the Phasis, which had originally been built with earthen ramparts and had at the time of his visit just been rebuilt with brick ramparts. The original fort in this case can hardly be earlier than A.D. 70-80. From an inscription found in the Carpathians we learn of a fort built not earlier than A.D. 110 and perhaps 30 years later, which had at first earthen walls, *muri cespiticii*, and was given stone ramparts in A.D. 201. Hadrian's Wall in Britain was probably first built (*circa* A.D. 122) in turf and reconstructed (*circa* A.D. 208) in stone, and the Wall of Pius was also built in turf (*circa* A.D. 142), but it is not yet clear how the forts on these two walls were provided with ramparts; the ramparts of the forts on the Wall of Pius seem to have been constructed, at least in part, of stone. These facts suffice to shew the limits within which the transition probably took place. Gellygaer is plainly an early experiment in the use of stone, and its ramparts seem to elucidate the method of the transition from earth to stone. It is exactly the same development as that by which the early earthen *tumuli* of Rome grew into stone structures like the tomb of Caecilia Metella and the Mausoleum of the Plautii. The original earthen mound was first surrounded with a comparatively low facing of masonry, such as may still be seen in the tomb of Pætus and Polla, then the masonry extended till at the end the earth disappeared wholly or almost wholly from use. And in these cases, as in the ramparts, there was a period of transition when earth and stone were both in use!"

The Gates.—The excavations showed that the gates were of one design and of similar dimensions. They were double, that is, each contained two passages, 11 ft. long and wide, separated by an intervening wall or *spina*. Front and back, these passages were narrowed to portals, 9 ft. 6 ins. wide, by projecting jambs or pilasters, which originally carried arches. On either side of the pair of passages was an oblong guard-chamber about 11 ft. by 9 ft. 6 ins. (internal measurements), entered by a narrow door at the back (Plate IV.).

The whole structure (passages and guard-chambers) was within the width of the rampart. The front or outer walls of the guard-chambers were simply continuations of the corresponding wall of the rampart, while the front pair of portals was set back nearly 6 ft. The back portals and the back walls of the chambers were in line with one another, but as a whole fell short of the inner face of the rampart by about 3 ft., an amount representing the thickness of the inner retaining wall, so that if produced, this wall would have passed behind the gate building. It, however, stopped short at the guard chambers, and its ends were fashioned into steps leading up to the rampart walk. The masonry of the passage sides and pilasters was the best met with during the excavations.

Each of the outer or front portals had been provided with a door of two leaves, which turned upon pivots. These leaves, in closing, stopped against a rim or sill of stone which crossed the threshold and thus covered and protected their lower edges; and in opening, they swung back into the recesses in the sides of the passage formed by the projection of the pilasters.

In one of the passages of the South-West Gate (Plate V.), the raised sill, pivot-holes, and bolt-holes were found intact. The sill consisted of two large pennant flag-stones (one over 7 ft. in length), end to end, and set on edge in the ground, the exposed upper edge being worn by traffic. Behind the sill were two more flag-stones lying flat on the road-level several inches below the top of the sill, and containing the pivot and bolt-holes. The road in front appeared to have been level with the top of the sill, and this was the probable explanation of its worn surface being bevelled towards the interior. The pivot-holes were

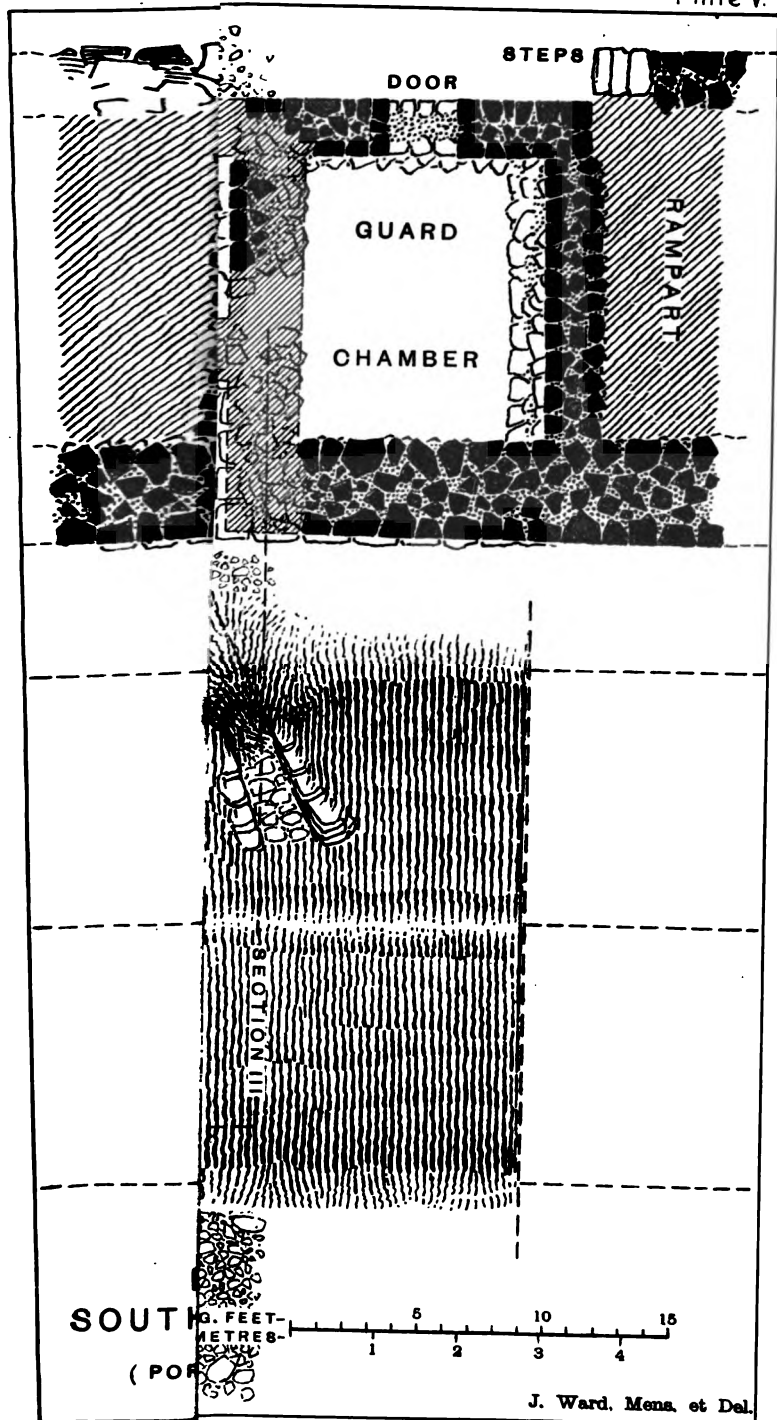
neatly made, $4\frac{3}{4}$ ins. in diameter and 2 ins. in depth, and were placed in the angles between the front pilasters and the side walls. The bolt-holes, of which there were two, were in the centre, oblong in shape, 2 ins. by $2\frac{1}{2}$ ins., and passed through the flag-stones. The sill exhibited two worn hollows, about 5 ft. from centre to centre, made by the passage of wheels.

In the other passage of this gate a portion of the sill remained, and this was also the case in the North-West Gate, while in addition to this, one of the passages of the South-East Gate retained its two bolt-holes. The North-East Gate had been too much destroyed* for the sake of its materials for any of these fittings to remain, but a loose block of stone containing a square hole of suitable size for a bolt was found on its site.

The roads through the gates were horizontal, or nearly so, except the *Via Principalis*, which in passing through the South-East Gate made a descent in conformity to the natural declivity of the ground there.

The guard-chambers were excavated down to the natural surface, but nothing could be determined as to their original flooring. The height of the door thresholds and of the internal set-offs implied a floor a foot or more above the old surface, but there was no indication of a dividing-line at that level in the accumulations that filled the chambers, nor was there any seam of decayed mortar or concrete, which might be construed as a floor. The only guard-chamber explored under my own supervision was the more perfect one of the North-West Gate, and my attention was there attracted by the large amount of charcoal and burnt stones on the old surface, a common feature, Mr. Haverfield tells me, in the guard and tower-chambers in the North, which is attributed to the cooking of food. The presence of square tiles, such as were frequently used for *pila*, in addition to the above, set me searching for the indications of a hypocaust, but without success. They were probably simply stacked here for building purposes, perhaps for breaking up for concrete, for in one of the chambers of the opposite South-East Gate was a large heap of finely-broken brick, covering most of the floor.

* About 43 years ago, the Rector informs me, when other depredations were made on the N.E. rampart.



Very little was disclosed by the excavations as to the super-structure of the gates. There was no doubt that the portals had been arched, for numerous fragments of voussoirs of the calcareous tufa already referred to, were found scattered about the sites. It was impossible to determine the original sizes of these voussoirs, as they were so much broken, but the largest pieces were about 11 ins. in height and 18 ins. in depth. The arches probably corresponded with those which still remain in partial completeness in Roman military structures in this country, that is, they were semi-circular, and sprang from imposts. No stones, however, of the usual impost form were found at Gellygaer, but considering the hardness of the pennant-grit, it is likely enough that the imposts were simply indicated by a projection of ordinary building stones. If the imposts were at their usual height of about 6 ft. from the ground, the height of the portals would be about 11 ft.

The gates, must, of course, have been roofed in some manner, but the evidence of the excavations was conflicting. On the site of the North-East Gate was a large number of broken roofing-tiles, clearly proving the former existence of a roof. I noticed fragments among the throw-out of the two lateral gates, but as there had been large tiled buildings close by, these may have been derived from them. On the other hand, I did not see any fragments on the site of the South-West Gate.

The strong sub-structure and arches of these gates imply, however, something more weighty than a roof. From various sources of information, we gather that it was usual to place a fighting chamber over the entrance to a city or fort; but as might be expected, the presence or absence of such chambers at Gellygaer could not be inferred from the excavations. The reader who desires to form some idea of what the Gellygaer gates may have been like, is referred to the sculptures on Trajan's Column, among which he will find camp and fort gates of various degrees of elaboration, from the simple opening in a rampart wall to the structure of tower-like proportions with an arched portal below and a substantial chamber above. Four examples of these gates are here given (Fig. 7). The first has no upper storey, but is simply surmounted with a pediment,

which may be the gable of a roof. The timberwork over the second portal is apparently the parapet of the rampart walk continued over the space. The third has an upper chamber of the more usual type on the column. The last is similar to the foregoing, but is of more elaborate construction, having an

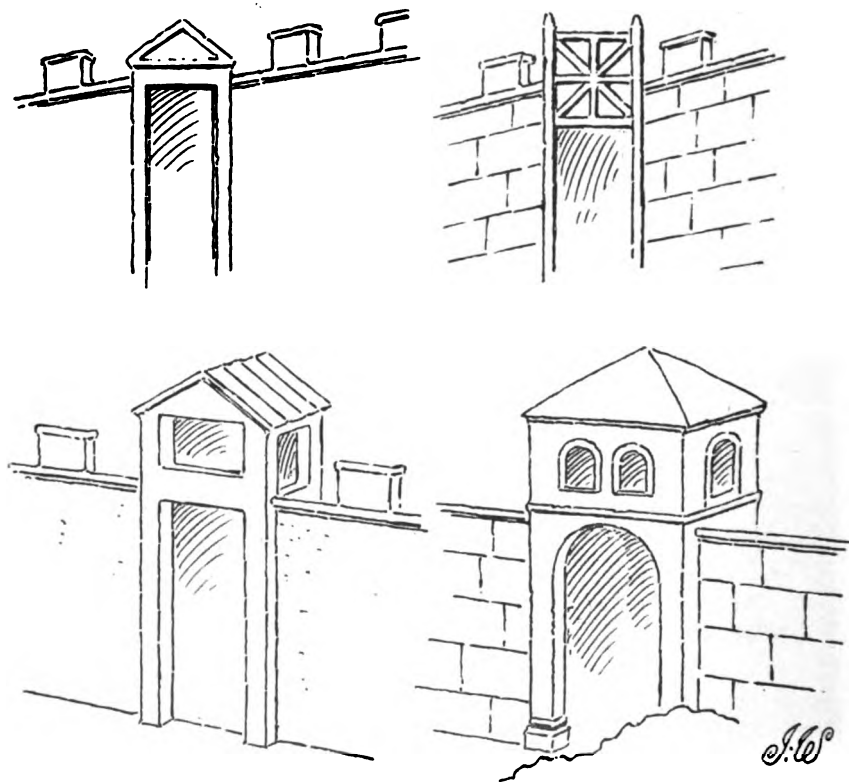


FIG. 7. GATES FROM SCULPTURES ON TRAJAN'S COLUMN.

arched portal, arched openings in the chamber above, and a hipped roof. In some of the gates which are closed, the doors are of two leaves, and in one, the very boards and nails are sculptured.

One of the most interesting features of the Gellygaer excavations was the modification of the ditch in front of the South-West Gate to receive the supports of the bridge. The ditch

there was found to pursue its V-shaped course, with this difference—the sides, about midway between the bottom and the brings, were stepped out (as indicated on Plate III.) for the length of 18 ft. immediately in front of the gate. The flat portion or “tread” of these steps was evidently intended to carry the supports of the bridge. It will be noticed that the outer half of each tread is several inches lower than the inner half. In the hollow thus produced, much broken stone was found, which had the appearance of disintegrated concrete. At first I took this concrete to be the foundation of stone abutments, but not a trace of masonry was seen, and it is hardly likely that in so sheltered a place a structure of this sort could have entirely disappeared. It is more likely that the broken stone carried wooden sleepers, from which posts supporting the bridge arose. The soil immediately above the concrete was looser than elsewhere, and this we might expect had the space originally been occupied by wood which has slowly decayed away. Whether the bridge was a fixed or a draw one, it is impossible to say from the evidence of the exploration. The width, unless the platform overhung the piers, was, as indicated by the latter, about 19 ft., or the combined widths of the two arched ways of the gate. The approach to the bridge was straight, portions of its foundation and gravel having been opened between the ditch and the present road (the Heol Adam), and indicating a track some 28 ft. in width.

In the left passage of the South-West Gate was a pile of stone which well-nigh blocked it. At first it was supposed to be fallen masonry from the upper part of the gate, but it was soon found to be definitely stacked. It consisted of stones suitable for building purposes, exactly similar to those used in the buildings of the fort, and some of them were dressed. They may have been deposited in the gateway to be handy for some building operations in the interior, but it is more likely they were placed there for removal in after times when the fort was a convenient quarry for the district.

The Towers.—At the corners of the fort, and between them and the gates, were found the remains of twelve chambers,

which, with little doubt, were the basements of towers. In plan they resembled the guard-chambers, but unlike them they extended over the full width of the rampart. To judge from their design and construction, they were all erected at the same time. In external length they correspond with the width of the rampart, that is, 20 ft. or under, and their width was a trifle under 16 ft., the internal measurements averaging 14 ft. 9 ins. by 11 ft. 6 ins. Each was entered by a narrow doorway, varying from 3 ft. 2 ins. to 3 ft. 9 ins. in width, in the middle of the back or inner wall. With the exception of that of the east, and possibly the other corner towers, these doorways reached the ground, in this respect differing from those of the guard-chambers, which had dwarf-wall sills.

As in those chambers, the front or outer wall of each tower was part and parcel of the front wall of the rampart; but on the remaining three sides it was a separate construction, not being bonded into the former; nor was it bonded into the back wall of the rampart. The inner side was faced, but none of the facing-stones were dressed, and the workmanship was rude. That portion which formed the back of the chamber was also faced externally, but in somewhat better fashion, dressed stones being occasionally used. The sides which abutted against the earth-work of the rampart were either not faced at all, or only roughly so, indicating, I think, that the bank was already there when these walls were built.

No trace of definite flooring was observed in these chambers. In that next the north corner, on the N.E. side—the best preserved of these chambers—was a layer of broken stone and rubble, such as might have served as the foundation of a floor. In the corresponding chamber on the S.W. side was a puzzling band of stones 5 ft. wide, which crossed it at a distance of 2 ft. from the outer wall (Plate IX.). The stones used were of all sizes, and were placed on edge like pitching, but of a very rough description. They formed a stratum a foot or more thick, and had the appearance of a foundation course.

The chamber at the north corner (in the Rectory garden) had two peculiarities. The side walls had broad footings, about 18 ins. in width, and three courses in height; and crossing the

middle of the chamber was a roughly-built wall, which appeared to have been an insertion, as it failed to quite reach the side walls. Unfortunately this chamber could only be partially excavated in consequence of a tree on its site.

The east corner chamber was the only one opened under my supervision. Although its excavation was incomplete, being hurriedly undertaken at the close of the exploration, it yielded some interesting results. The outer portion appeared to have been removed at no distant time for the sake of its stone, so the digging was confined to the portion next the interior of the fort. The back wall, of which four or five courses remained, showed no sign of a doorway, but there is little doubt that there had been one at a higher level, for there was a natural declivity here, necessitating the raising of the adjacent street. Lying upon the natural ground within the chamber was a variable thickness of earth, rendered nearly black with soot and fine charcoal. This layer was thickest in the south corner, where also were found a few animals' bones, some broken, and apparently belonging to the ox. Upon and near the top of this dark stratum lay many large fragments of roofing-tiles, several of which could be "pieced" together. They were mixed up with a good deal of broken stone, and many pieces of charcoal were met with. Above all, was a foot or more of ordinary soil and vegetable mould. The conclusion I came to was that the tower had been roofed with tiles, and that it had fallen in, the disaster apparently being brought about by fire. It also seemed clear that the dark earth, or much of it, was already there when the conflagration took place, and that it indicated that fires had been habitually lighted in the basement for cooking purposes.

It is unfortunate that not one of these corner chambers was thoroughly explored. I observed much dark earth and charcoal in the north corner chamber—that in the Rectory grounds—also a few pieces of roofing-tiles in the throw-out; but the slight excavation—sufficient only to disclose the plan—of that at the west corner failed to reach the requisite depth, while the south corner was not attempted, being under the cottage garden.

Several of the intermediate chambers, on the other hand,

were fully excavated, but in none of these, or indeed of the partly excavated ones, did I see evidence that the diggers had met with similar features to those of the east corner chamber. I searched the spoil-heaps for roofing-tiles, and found either none at all, or only an occasional fragment, such as might well have strayed from elsewhere in the fort. It certainly looks as though these chambers were not roofed with tiles. If so, they could not have corresponded with that of the east, and presumably those of the other corners, similar as they are in plan. Indeed, it is possible that these intermediate structures were not towers at all. I mention this,

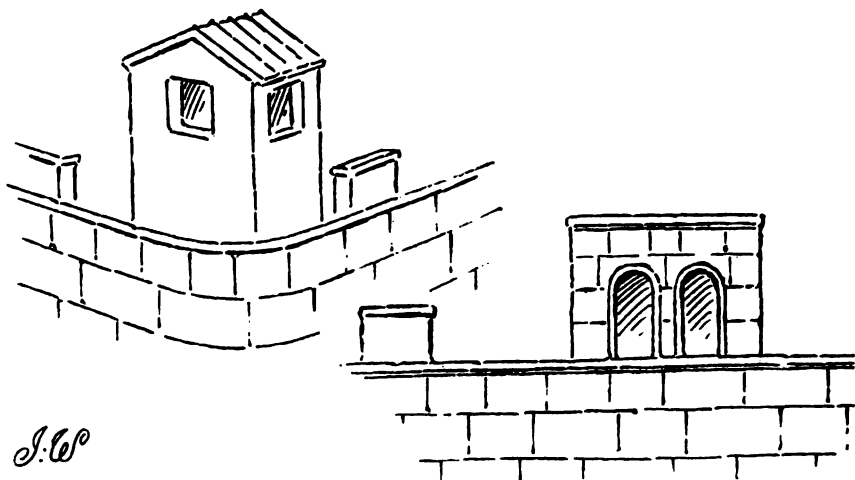


FIG. 8. TOWERS FROM SCULPTURES ON TRAJAN'S COLUMN.

because some small forts had not more than the four corner towers. Melandra Castle and Hardknott, forts of similar size to Gellygaer, are examples to the point.

Trajan's Column furnishes several examples of towers, two of which are here sketched (Fig. 8). The one is not roofed, and is built of stone; the other, which appears to be a corner tower, is roofed and is apparently of wood, as no masonry joints are indicated. Probably the superstructure of the Gellygaer towers was also of wood, for the lower walls were decidedly slight, contrasting in this respect with those of the gate guard-chambers.

Method of Construction.—It need hardly be said that a highly disciplined and organized army like the Roman, would construct its camps and forts according to a set, and probably a traditional, procedure. Any hints, therefore, that the exploration of the Gellygaer rampart may have afforded as to the order in which its several parts were raised cannot but be of general interest.

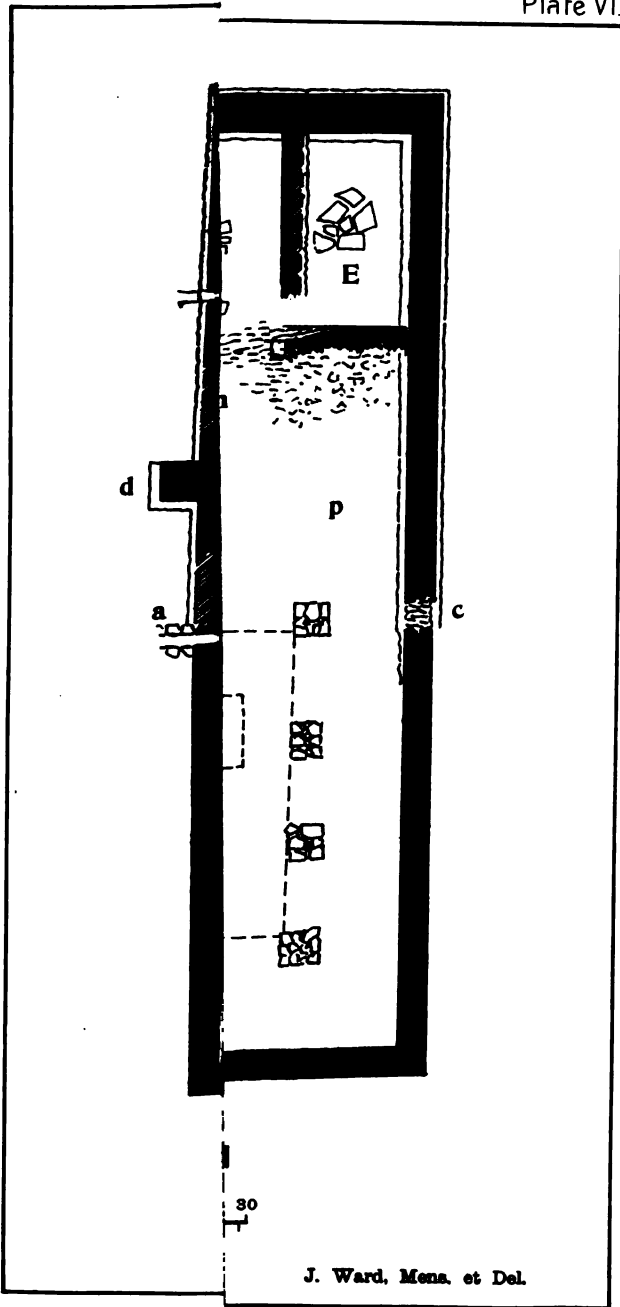
As stated above, there is good reason to think that the outer and inner walls, and the sides of the guard-chambers and tower-basements, were built *against* the bank, that is, the bank was already there when these were erected. As the bank was mainly derived from the ditch, the ditch necessarily is an earlier link in our chain of sequences. In digging this ditch, the soil was piled up behind its inner lip to form a rampart, four gaps of 25 Roman feet being left for the gates. That this was the first operation is likely enough, for the first care would be to provide a defensive barrier. Then followed, but whether before, after, or simultaneously with the bridges, we cannot say, the erection of the outer wall, which was returned at right angles for 5 or 6 ft. at the corners of the gate-openings.

In its turn, this was followed by the erection of the masonry of the gates and the towers. The first step would be the removal of the bank at the places to be occupied by the guard-chambers of the former, and the basements of the latter. This may seem a roundabout process, but the exploration showed conclusively that the outer wall had been equally built against earth *at these places* as elsewhere. The men who raised these structures used smaller stones than those used in that wall, against which their work simply abutted. The difference between the two masonries was seen in all the guard-chambers which were sufficiently preserved, the returns of the rampart wall being in higher courses and upon a higher set-off than those of the pilasters and their intervening recesses, and the difference was almost as noticeable inside the chambers. In the left chamber of the North-West Gate, for instance, those who laid the foundation of the secondary work not only made their trench less deep than that of the rampart wall, but failed to carry it up to the return of the latter, thus leaving a wedge of natural soil between the two which was very puzzling until the reason

was discovered. It was also noticed that while the foundation of the return was roughly coursed, that of the secondary work was of stones set on end.

That the inner retaining-wall of the rampart was subsequent to the gates and the tower-basements cannot be doubted, as it simply abutted against these structures, and its line was determined by their projection.

We have thus evidence of stages in the construction of the Gellygaer rampart and its appendages, but there is no ground for thinking that any of these imply a lull, whether of weeks or years, or a change of plan. My conviction is that they represent the *modus operandi* of the soldier-masons of old, and should put us on our guard against the hasty interpreting of like features in other Roman forts to indicate the presence of work of different periods.



J. Ward, Mena. et Del.

SECTION VI.

The Buildings of the Interior.

A GLANCE at the general plan of the fort will show that the buildings of the internal area were of various shapes and sizes, and from this the reader will infer, and rightly so, that they were designed for different uses. To attempt to define these uses, would, in our present state of knowledge, be little else than mere guesswork; but the comparative study of the remains will materially pave the way to that end.

The thought will occur—were these buildings arbitrarily designed, or did they conform to types which had been slowly evolved by successive military engineers? If a number of plans of Roman forts, that of Gellygaer included, be compared, it will be found that while in no two of them do these buildings exactly agree, there is a general correspondence both in their forms and distribution. This proves that in no instance were they specially created for a particular fort, but that the requirements which brought them into being were common to all. The differences, being of a subordinate nature, must be regarded as modifications due to differing local or military conditions, or to the whims of the builders.

If the plans be further analyzed, the internal buildings will, with few exceptions, resolve themselves into these four types:—

(1) There is a single four-sided building of remarkably uniform plan, near the centre of every fort. It is always situated on the *Via Principalis* about midway between the lateral gates, and on the side next the back of the fort. Its wide portal looks towards the front gate, and gives direct admission to a court-yard more or less completely surrounded by a covered ambulatory. Behind this yard is another space, probably also roofed, into which, on its further side, opens a suite of several

rooms, of which the middle one is apparently the most important. The use of this building has not been fully determined, but it may safely be regarded as the head-quarters of the fort. It is the *forum* of some antiquaries, and the *pratorium* of others. Each term has a certain appropriateness, for the structure is somewhat *forum-like* in plan, but occupies the position of the *Pratorium* of classical writers, and for this reason alone, the latter term is used in these pages.

(2) In all these forts, one of the blocks in the range of buildings along the *Via Principalis* is a large house-like structure. That at Gellygaer (VI.) is a typical example, and has the advantage of great simplicity. Here we note a central court surrounded by a corridor entered from the *Via Principalis*, and around this nucleus are arranged the rooms, the whole forming a square building. In the larger forts the corresponding building is larger and more intricate, recalling some of the houses which have been brought to light at Silchester. Housesteads, and perhaps Birrens, have two of these buildings each. Those at Great Chesters and Chesters contain hypocausts. It is generally thought that these buildings were residences, probably of the commanding officers of the different forts.

(3) In the same range, or, at all events, in some central position, may be noticed two or more oblong buildings, usually strengthened by buttresses. At Gellygaer there is one near each of the lateral gates (V. and VIII.), but instead of standing singly they are often built in pairs, with only an eaves-drop between them. In this form they occur at Housesteads, Hardknott, South Shields, Chesters, and High Rochester, the last having two pairs, one on each side the *Pratorium*. A characteristic of these buildings is the provision for an elevated floor. The floor itself has in every case disappeared, but the supports usually remain. These consist of a series of parallel walls, or of pillars. This is a common hypocaust arrangement, but there is no satisfactory proof that the space below the floor was used for artificial heating; on the contrary, in the description of the Gellygaer examples, reason will be given for thinking that the object was the free circulation of air to keep the floor dry. The use of these buildings is uncertain, but probably they were store-houses.

(4) In *most* of the plans, the rest of the internal space, corresponding with the *Pratentura* and *Retentura* of the Hyginian camp, is occupied by a number of long narrow buildings, usually placed transversely, but occasionally, as at Housesteads and Camelon, longitudinally. They are generally of slighter construction than those described above, and may in some cases have been wholly built of timber or other perishable materials. This probably explains their absence on the Hardknott and Melandra plans; their former existence at the latter fort is, however, assured by the presence of earthen floors under the turf. Frequently these buildings are in pairs, like the buttressed structures described above.

At Housesteads and Chesters, their division into apartments by cross-walls is well seen, and at the latter place, Gellygaer, Camelon, and Lyne, some of them may be described as L-shaped in plan, the wider end, corresponding with the foot of the "L," being next the rampart. These long buildings are usually regarded as barracks, but it is quite likely they were used for several purposes.

I now proceed to describe these buildings at Gellygaer in detail.

The Prætorium.—In size, the Gellygaer *prætorium* is 80 ft. by 69 ft., or somewhat below the mean of the British series, the largest of which, Chesters, is 123 by 97 ft., and the smallest, Hardknott, 70 ft. by 70 ft. In plan, it is simple, and conforms to the British type, the only exceptional feature being the external projection of the middle room at the back. We may regard the plan as divisible into two chief parts:—(i.) an anterior court-yard entered from the *Via Principalis* by a doorway 9 ft. 6 in. in width, and surrounded on three sides by a covered walk or portico; and (ii.) a posterior portion containing a wide space, probably also covered, with a range of five rooms opening into it.

The plan on Plate VI. will show that these two divisions are co-incident with a difference in the thickness of the external wall—that enclosing the peristyle being 2 ft. in thickness, and the rest about 3 ft. Instead of the thicker wall joining

up with the thinner, there is on either side of the site a break (*a* and *c*), that on the left serving for the passage of a drain, and obviously made for that purpose; but that on the right is difficult to explain, there being no indication of a drain, and it is too narrow for a doorway. This difference in thickness is probably explainable on structural grounds, the thicker wall originally being loftier than the thinner, or having a heavier roof to carry. This view is enhanced by the buttress-like projection there on the left side (*d*). There is a general reason for a buttress. The natural slope of the ground is towards that side, and as the site was brought to a level by the removal of soil from right to left, there is a thickness of "made earth" on the left side. The wall, therefore, on this side, might well have needed support to withstand the thrust of this earth; but this does not explain why there should be only one buttress, and why it should be in its particular place. Evidently, it was because at this place the wall had to do more work than elsewhere. These structural details will be found to throw light on the construction.

The peristyle offers little difficulty. Its central open space (24 ft. by 47 ft.) is defined by the foundations—masses of rough masonry about 3 ft. square—of the pillars which supported the surrounding roofs. As nothing that would contribute to stone or brick pillars was found on the site, we may conclude that they took the form of wooden posts. These posts were a trifle over 8 ft. apart from centre to centre, except that the spaces facing the entrance were considerably wider (*e* and *f*) so as to allow of a wide thoroughfare through the heart of the building. The ambulatory was about 9 ft. in width, with a roof of a lean-to description, undoubtedly low rather than high so as to afford effectual shelter to the walk, and covered with red tiles of the usual form and size, of which many fragments were found on the site.

Between three of the pillar-bases on the left side was found a rough edging of stones (*h*) laid flat, which with little doubt extended all round the yard except across the wider spaces just referred to, and formed a kerb to the ambulatory; its presumed course being shown as a dotted line on the plan. In the yard

were patches of what appeared to be rude flagging, but which may have been the foundation worn smooth of a gravelled surface, as much gravel was observed.

On the left-hand in this yard was a well, circular and walled, 2 ft. 6 ins. in diameter, and 13 ft. 6 ins. in depth, its bottom being in the rock. As might be expected, it was choked with soil, stones, and broken pottery and tiles. Whilst open, no spring-water found its way into it; but this is not surprising, as throughout the district the springs have been reduced through mining operations. On the opposite side of the yard, a pit (*j*) about 6 ft. square was re-excavated to the depth of 6 ft., but it is questionable whether the bottom was reached. The curious thing about this pit is that its filling was pure natural soil, that is, soil free from potsherds, charcoal, etc., and this seems to show that it was filled in soon after it was made. Such a pit might have been dugged for a cistern, and then abandoned for some reason. The rain-water in the yard was conveyed to the sewer in the adjacent lane by a drain (*a*) which crossed the ambulatory.

Between the last two pillars on the left of both the near and far sides, was a pile of stones (*l, m*) about 3 ft. across. These piles were mistaken at first for ruined pedestals of some sort, but were afterwards found not to be definitely built. They seemed to be mere stacks of stone resting on the floor of the ambulatory, but it is singular that their positions should have corresponded with one another. Below the near stack was a portion of the kerb referred to above, and under both was a little gravel. Elsewhere the ambulatory floor showed traces of gravel, and we may assume from the presence of a kerb that this floor was raised above the level of the yard.

We now pass into the space between the yard and the range of rooms. This space was thinly gravelled like the ambulatory, and I believe that it was roofed. Its considerable width—22 ft.—would admirably adapt it for a concourse of people.

The front and divisional walls of the rooms were built of small stones upon superficial foundations, and this explains their tumbled-about condition when found. Towards the right, a layer of stones was mistaken at first for rough pitching (*n*), but

it proved to be a fallen portion of the front wall of the adjacent rooms. The Rector informs me that a similar layer occurred at the corresponding place on the left. Where these walls had fallen, scarcely a vestige of the foundations remained, so superficial were they; and for this reason it was not easy to make out their line, and the positions of the doorways. There certainly was no direct communication between Room E and the space in front, for the intervening wall was intact to the height of nearly 2 ft., and showed no signs of a doorway. There was a break at the lower end of the wall of this room and the next (D), which implies a doorway. The distribution of the fallen *débris* was highly suggestive of a doorway through the front of the latter room. The corresponding rooms on the opposite side of the area (A and B) were similar in proportions to these, but not quite so in respect to communications. There certainly was no door between them. Several courses of the left-hand portion of the front wall of the former remained, but towards the right there were signs of a gap marking a narrow doorway. As the continuation of this wall in front of the next room (C) was quite gone, we could only conjecture that it contained an opening.

Immediately behind the fragment of wall just alluded to, and consequently in the lower left-hand corner of Room A, was a sink slightly below the ground level. Its drain passed through the main wall of the *Prætorium*, and thence emptied into the sewer of the lane outside. The sink was constructed of three thin flag-stones—one forming the bottom which sloped towards the drain, and the other two, the sides—next the main wall, and it was extended by means of a roofing-tile, which had a similar slope. This sink is shown on a larger scale on Plate IX.

The middle room (C) was the largest of the series, and its importance was marked by the external projection of its back wall and the slight set-forward of its front wall. The back and the side walls had no break in them, and at the extremities of the latter were the returns of the front wall. These returns were each about 4 ft. long, and left an intervening gap of 11 ft. 6 ins., which undoubtedly marked a doorway, but whether of so great a span is uncertain. The returns had broken ends.

The excavations supplied little information as to the floors of these rooms. There were no indications of mortar, concrete, or *opus signinum*. About the middle of Room D, and on the natural soil, was a patch of thin pennant paving, about 3 ft. across, which may be regarded as a hearth, as it had been much subjected to the action of fire. In the adjoining room (E) was a similar paved space, but showing little or no effect of heat. These patches presumably represented the floor-levels of these two rooms, and, if so, the rest of their floors must have been of earth. The floors of all the rooms except the middle one had traces of charcoal and burnt earth, particularly that of B. In this respect they contrasted with that of the middle room (C), the soil of which retained its natural cleanness, indicating, perhaps, that its floor was originally of wood.

A further comparison of the Gellygaer *pratorium* with other examples will not only confirm, but will amplify some of the foregoing conclusions. Any doubt the reader may have had as to whether the first large space was open to the sky, will be dissipated when he is reminded that the corresponding spaces at Chesters, Housesteads, and Birrens are surrounded by a well formed stone gutter. As the chief use of a gutter in this position was to convey away the drip from a roof, we may infer that the ambulatory roof sloped towards the court.

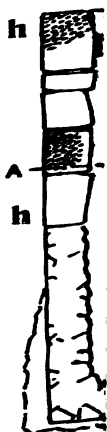
The second space is commonly regarded as a second open court, the "Querhof"—cross-yard—of the German antiquaries. To my mind, however, the Gellygaer plan does not lend itself to this treatment. The roof which the pillars on the further side of the first space supported, must have spanned the whole width of the second space in order to find a support for its opposite side. This is so obvious, that it would never have been questioned, had not certain *pratoria*, like those of the three forts named above, contained a second row of pillars to allow of the ambulatory roof on that side to be of the same width as on the other three sides of the court. A roof of this width would, of course, only cover the front portion of the second space, and thus seem to countenance the "querhof" theory. If a second row of pillars in these *pratoria*, why not a second row at Gellygaer? Such pillars were carefully looked for but were

not found. I hold that there are two types of *pratoria*; that to which the above three examples belong containing two rows of pillars, and that to which Gellygaer, Hardknott and, apparently, Camelon, Melandra and High Rochester belong, containing a single row. The structural difference between the two types seems to be, that in the one the ambulatory surrounded the court in its normal width, while in the other it, strictly speaking, passed round three sides only, and abutted against what might be described as the great "cross-hall." In the first type an open space between the ambulatory and the five rooms was structurally possible; nevertheless it seems to have been covered, for in the three large *pratoria* mentioned as of this type, the second space is *not* surrounded, like the first, with a stone gutter.*

How the "cross-hall" at Gellygaer was roofed we can only guess. It is reasonable to think that it was a gable roof, and, as Mr. G. E. Fox, F.S.A., suggests, of greater height than that of the ambulatory, in order that sufficient light might be admitted for the wider space it covered. The position of the buttress immediately below the apex of the left gable, becomes now explainable, as the wall there would be highest.

The range of rooms at the back is an essential feature in the *pratoria*, and it is interesting to note how usually their number is five. At Housesteads, Birrens, Chesters, and often in Germany, the number is manifestly five, and these rooms in the first two exactly agree with those at Gellygaer in the arrangement of their openings. At Ardoch, Great Chesters, High Rochester, and some of the German forts, they appear to

* Upon this question Mr. Haverfield makes the following observation: "The theory that the inner court of the so-called 'Prætorium' was roofed seems on our existing evidence to be unlikely. (1) No definite trace of a roof has been noticed anywhere. (2) At Lambæsis, where the central building closely resembles the type visible at Gellygaer and elsewhere, the inner court cannot possibly have been roofed. (3) At Gellygaer itself, the walls of the five rooms on the one side and the posts on the other seem to have been too weak to support a necessarily large and heavy roof. If the inner court was roofed, we must suppose a very different type of building from that which we imagine on the idea that it was not roofed. With a roofed court, the 'Prætorium' would resemble the Silchester Forum, the roofed court itself corresponding to the Basilica, and the five chambers behind it corresponding to the six or seven rooms behind the Basilica. In that case one would be tempted to suggest that the Forum and the 'Prætorium' had a common origin. Unfortunately the rooms behind the Silchester Basilica do not recur in the same place in the Basilicas of other towns."



be imperfect through the disappearance of walls, but they are plainly based upon a quinary division. Melandra and Hardkott show a range of three rooms each, but as the end rooms are unusually wide, it is probable that they were originally divided into two rooms each by a slight wall which has disappeared. The importance of the middle room is not usually emphasized structurally as at Gellygaer, in the British series, but it is the rule in the German. The vault or *ararium* which is frequently found under, or at all events entered from, this room in both series, is absent at Gellygaer.

What these rooms were used for is quite uncertain, but it is reasonable to think that the arrangement of five in widely separated forts implies that their uses were definite and fixed. The middle room is frequently regarded as the *sacellum*, and it may well have contained a shrine, and have been the place where the standards and the treasure were kept. At Housesteads it was open to the "cross-hall" by almost its whole width, as appears to have been also the case at Gellygaer, but was divided off by a timber fence of some sort, leaving, however, a central opening or gate.

At the right-hand end of the "cross-hall" was a scattered heap (P) of broken brick similar to that found in one of the guard-chambers of the South-East Gate.

Among the debris that filled the well, and at or near the bottom, were two worked stones of uncertain use. The larger (Fig. 9) is 23 ins. square, from 3 ins. to $4\frac{1}{2}$ ins. thick, and perforated by a central circular hole, about $4\frac{1}{2}$ ins. in diameter. It was evidently cut out of a large field stone. The upper and lower faces and one side retain the old weather-worn surface, while the remaining three sides and the central hole have been hewn, the latter with considerable care. The dressing of the sides, however, is fresh-looking, while that of the hole is worn. Various opinions have been given as to the use of this stone. One is that it covered the well and gave support to a leaden pump; another, that it formed the top of a raised superstructure over the well, the rope which raised the bucket passing through the hole; another, that it was the gully-stone of a drain. The Rector of Gellygaer suggests that it was one of the upper pivot-

stones of the gate. This, however, it could hardly have been, for the hole exhibits no trace of the striation that a revolving door-pivot would give rise to.*

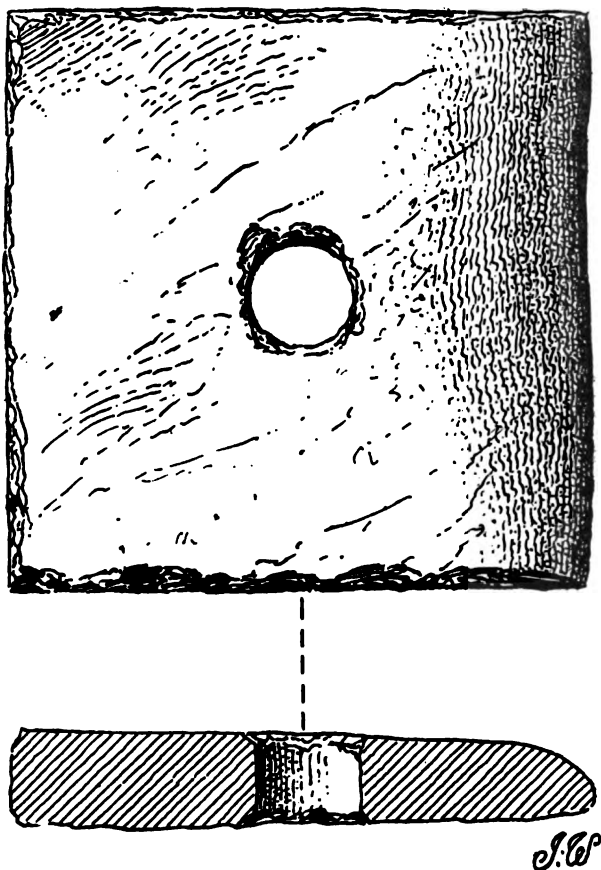


FIG. 9. PERFORATED STONE FROM THE PRÆTORIUM. ($\frac{1}{2}$).

* A perforated flag-stone closely resembling the above forms part of a stile at Penwyrld Farm, near the fort. With little doubt it originally came from the fort, where it served a similar purpose, whatever that may have been. This stone was the subject of much controversy between Mr. Seaborne and the late Mr. John Storrie in the *Western Mail*, in August, 1903. I observed a similar stone on the site of the Prætorium of Housesteads, but the hole was larger and less carefully made.

The other stone (Fig. 10) is a disc, with a smooth upper, and a rough lower face, approximately $4\frac{1}{2}$ ins. in thickness. The edge of the upper face has evidently been worked from a circle $13\frac{3}{4}$ ins. in diameter, scribed on it by a pair of compasses, but the sides lower down are left in a comparatively rough condition.*

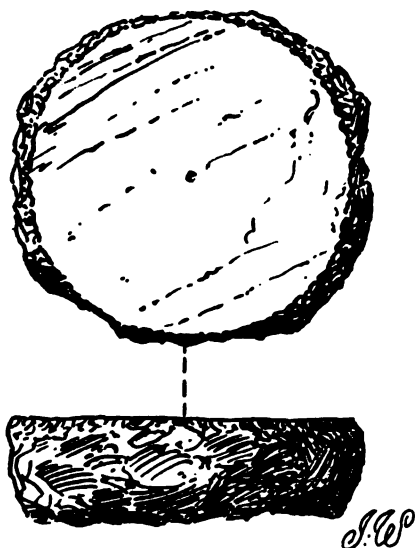


FIG. 10. CIRCULAR STONE FROM THE PRÆTORIUM. ($\frac{1}{2}$).

The House-like Building (VI.).—The excavators so thoroughly did their work here that little else than the *plan* was left for me to work at. The simple arrangement of this plan has been sufficiently described. The accumulation of *débris* over the site seems to have been slight, indicating a building of low elevation, or one largely constructed of wood; consequently, the remains of the walls were reduced to only the foundations and footings, too low for the thresholds of the doors to remain. Nothing was left to tell of the floors of either corridors or rooms,

* A portion of a monumental slab "roughly shaped into a circular form and used as a hearth-stone" was found in the Cawfields Mile-Castle. It was 2 ft. in diameter.—Bruce's *Roman Wall*, 3rd edition, page 231.

but it was clear that towards the S.E. side the ground had been raised so as to bring the whole site to a level, and overlying this moved soil within the south corner was a patch of broken stone about 13 ft. square. Near the west corner a large drain entered the building, but stopped short with the inner side of the wall, and nothing could be made out as to its further course or use, the ground in the vicinity having a tumbled-about appearance. It was clear that the building had been roofed with red tiles, for their fragments were scattered over the site. In two of the rooms I noticed tiles resting directly upon the natural ground, which seems to indicate that the floors here had been of wood. As stated on page 30, much window-glass was found on this site.

In plan, this building more closely resembles a corresponding building at Housesteads than those in other forts, still less does it resemble any of the Silchester houses; but its similarity to "House No. III." at Caerwent (*Archæologia*, Vol. 57, p. 301) is remarkable. In both, the rooms surround a central court, which is entered from an external corridor or passage, the length of the building. This corridor was open at the ends at Gellygaer, and apparently this was originally the case at Caerwent, the end best preserved having been stopped at a later date than the construction.

The Buttressed Buildings (V. and VIII.).—These two buildings were remarkable for their strength and the height to which their walls remained, due in great measure to the large accumulation of *débris* which covered the sites. From these features—the thickness of the walls and the height of the *débris*—we may infer the greater height of the buildings than the average.

The enlarged plans on Plate VII. will show that the middle portion or body of each building was oblong—59 ft. by 34 ft.—and that to each end was appended a structure of slighter build, of the full width of the preceding, and making the total length about 83 ft.

We will consider this middle portion first. The footings of the side walls were nearly 6 ft. in width, and those of the ends 4 ft. or more. Their upper surface was lower than the

contiguous streets, but unequally so, being horizontal while the ground around sloped. Upon this platform rested the superstructure (or what remained of it) shown in solid black on the plans. The interior was divided into six narrow compartments (*a, a*) in the one building, and into seven in the other, by thin transverse walls, each of which contained a central opening (*b*) about 3 ft. wide, reaching down to the footing. Externally, the positions of these, as also the end walls, were marked by a series of buttresses, about 2 ft. in width and projection. In the side walls, between the buttresses, were the remains of window-like openings (*c, c*) into the compartments, which were originally a trifle over 4 ft. in width, but had been reduced to about 3 ft. These openings were on the street levels, and so varied in respect to the footings; those of Block V. being only a trifle above the latter, whereas on the N.E. side of Block VIII. several courses intervened. The external masonry, especially of the buttresses, was well constructed, and nearly all the facing-stones were more or less dressed; but no dressed stones were used in the interior.

In the former building (V.) the natural soil was reached without the slightest indication of a floor of any sort, but in the latter (VIII.) an unexpected bottom was found—the lower courses of eight cross walls (*d, d*) with the narrow intervening spaces filled up with rough stones packed on edge (*e, e*), the whole forming a tolerably level surface upon which the subsequent series of five walls was erected (see the section on Plate VII.).

The first impulse was to regard the two series of walls as proof of the sequence of two buildings upon the site. There was, however, no indication that the outer walls had been rebuilt, so that, if any re-building had taken place, it must have been confined to the divisional walls. But the fact that these were *bonded* into the former, points rather to a modification during the progress of the building, than to a re-building. The ground hereabouts makes a rapid descent, and it is likely that after the erection of the lower courses of the first set of divisional walls, it was found necessary to raise the site to their level by packing; the building being resumed subject to the modification just referred to.

In the diagrammatic view (Fig. 11) of one of the buttresses and cross-walls on the N.E. side of Block V., it will be observed that the inserted cheeks of masonry (indicated by shading) by which the opening was made narrower, rested upon a bed of mortar about 5 ins. thick. This bed was probably continued from side to side of the original opening, and formed its sill. There were no indications as to how these openings were treated, or their original height.

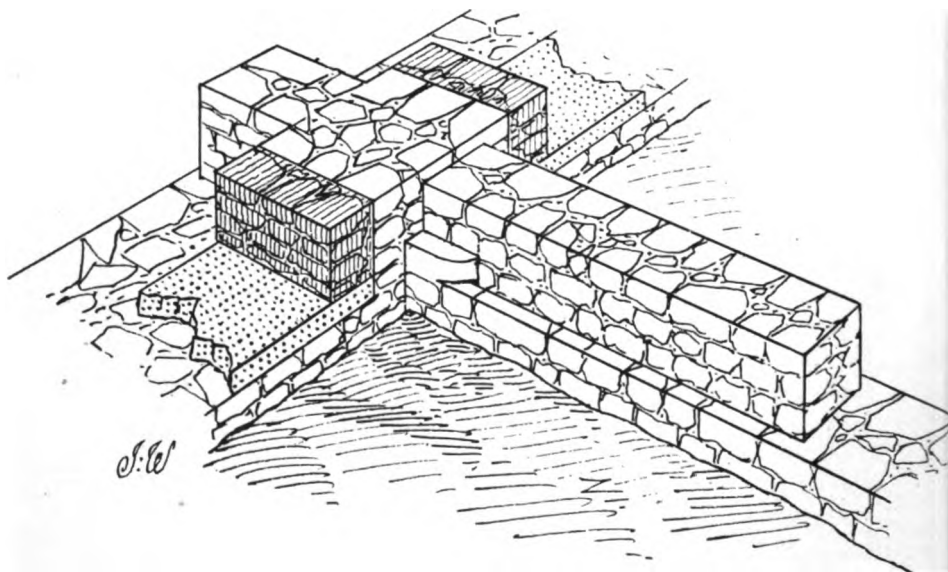


FIG. 11. DIAGRAMMATIC VIEW OF STRUCTURE OF "BUTTRESSED BUILDINGS."

We now pass to the appended structures. But little acquaintance was needed to see that their walls, which were a trifle under 3 ft. in width, were never of greater elevation than their best preserved remaining portions. These portions were capped with large flag-stones of the full width of the wall, at a height of 1 ft. or less above the street level outside. The positions of these flag-stones are shown on the plans, and two may be observed in the foreground of Plate VIII. Those at *f*, *f* were worn, evidently by the feet; whereas those from *h* to *h* were not worn, and in two places were neatly chiselled down to a true surface.

These surfaces are shaded on the plan, and it will be observed that if repeated at the same distances apart, there would be four of them along this end of the block. Mr. Clarke's suggestion that these were prepared for the posts of a verandah, or of a timber-framed wall, is a reasonable one.

Within each of these appendages was a platform of rubble (i, i) built against the end wall of the main structure, and of similar height. These platforms were about 9 ft. 6 ins. in width, and their projection was from 6 to 7 ft. We shall refer to these again shortly.

What these remarkable buildings were like in their completed condition has been much discussed, but a comparison with the corresponding buildings in other forts gives us a clue. In the better preserved of these we find the internal space traversed by a number of longitudinal walls, as at Birrens, Hardknott, Chesters, Housesteads, and Kastell Butzbach, or transverse ones, like those at Gellygaer, at Lyne; or instead of walls, we find pillars, like those of a hypocaust, at Housesteads and South Shields. These imply suspended floors, but in no instance has there been reason to suppose that the under space was a hypocaust; in fact, in several, the supports are too widely placed (as at Gellygaer) to admit of being spanned otherwise than by timber beams. The Gellygaer examples are in advance of the rest, in the series of openings they disclose. These hint that the purpose of the under-space was the free circulation of air to keep the floor above dry. We have no means of determining the height of the floor, but it was certainly several feet above the external level, and evidently higher than the existing remains, for no signs of a door-threshold to such a floor remained.* Here again the comparison of similar buildings elsewhere comes to our aid. In every case where the doorways are still indicated, they are at one or both ends. At Housesteads they occur at both ends, each reached by a flight of steps, and at High Rochester, at one end. At South Shields the actual thresholds are obliterated, but their position at one end of each building is indicated by the remains of a portico. These examples,

* Mr. Rodger remarks that the floor would probably pass through the doorways without the intervention of a threshold.

especially the latter, turn our attention to the appended structures at Gellygaer. The worn step and indicated posts of the outer walls are suggestive of a portico or lobby; while the rubble platform within might well have formed the support of a staircase leading up to a floor opening on to the raised floor of the main structure.

That these Gellygaer buildings had been roofed with the usual red tiles was amply proved by the abundance of their fragments on the sites, and the circumstance that in one building these fragments lay directly upon the natural soil, and in the other, upon the packed stone, goes far to confirm the view given above, that their floors were of wood. Within each compartment, and immediately below the openings at the ends, lay broken lengths

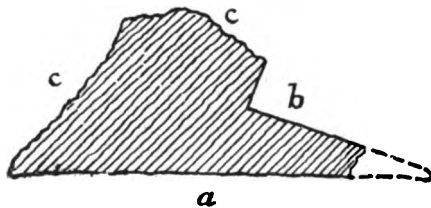


FIG. 12. SECTION OF CONCRETE FILLING, "BUTTRESSED BUILDINGS. (1).

of brick concrete of the general section here given (Fig. 12). The side *a*, varying from 12 to 14 ins. in width, was smooth, and had been the exposed face; *b* and *c* were rough from contact with a rough surface, and the recess *b* showed the imprint of timber. From the position and shape of these lengths of concrete, it seems certain that they had fallen from the cheeks of the openings.*

* That these buildings were store-houses is almost beyond question. It is said of the corresponding buildings at Birrens, that "the floors in order to be dry were raised on walls with air-ducts between them," and that a quantity of *calcined wheat* was found in one of the buildings (*Proc. Soc. of Antiq. Scot.*, vol. XXX., p. 112). At Ribchester, Mr. John Garstang made some excavations in 1899 upon the site of a "strong building" near the *Prætorium* of the fort, which evidently had a suspended floor, for he found the remains of *pila*, 3 ft. 6 ins. in height. Lying upon the ground between the *pila* was a compact layer of charred grain, 2 ft. in thickness, and over it was much charred wood and roofing-tiles; and Mr. Garstang's conclusion was that the place was a granary and that it had been destroyed by fire. Similar finds have been noted elsewhere.



M. T. Seymour.

N.N.E. VIEW OF "BUTTRESSED BUILDING" (BLOCK VIII.).

[Photo.

The "Long" Buildings.—The regions—the *Pratentura* and *Retentura*—occupied by these buildings, being less thickly covered with *débris* than elsewhere, are relatively lower, and so constitute the "lowlands" of the site. From this, we may infer that as a rule these buildings were not lofty, or else were largely constructed of perishable materials, as timber. Of their walls rarely more than the foundations and footings remained, and of the floors, only the vaguest indications. From the absence of roofing-tiles on their sites, it may be concluded that their roofs were of wood, or were thatched.

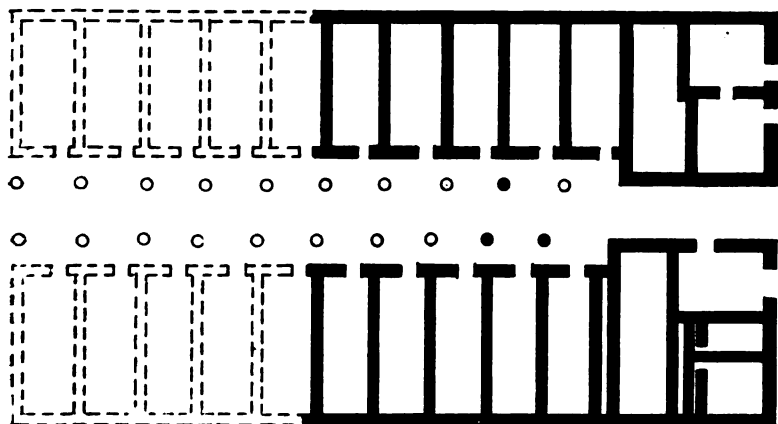


FIG. 13. PLAN OF "L-SHAPED" BUILDINGS AT CHESTERS.

The more noteworthy of these buildings were six of the L-shaped form—four in the front portion of the fort, and two in the back. They varied so slightly in shape and size that we may consider their differences as accidental. Their average dimensions were:—145 ft. 6 ins. in length, 36 ft. across the wider portion, and 30 ft. across the narrower. In each there was a divisional wall which crossed the former portion about 15 ft. from its junction with the latter, giving rise to an oblong room next the rampart, and a long narrow L-shaped one in the opposite direction. In the case of one of these buildings (II.) the end room was sub-divided by an additional cross-wall.

Blocks XII. and XIV., and a large portion of XIII. and XV., came within the region of the diagonal trenching, but the trenches threw very little light upon their flooring. In the end apartments of the former two, were patches of what seemed to be paving; and in their narrow portions were doubtful traces of rammed earth and gravel. As might be expected, all indications of doorways had disappeared.

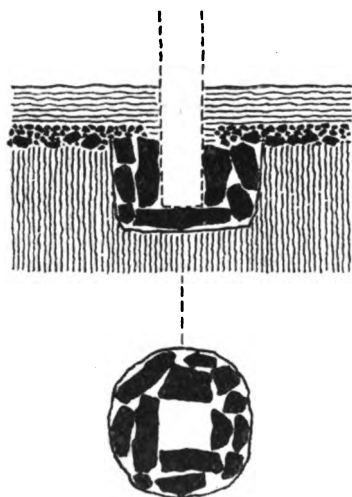


FIG. 14. PLAN AND SECTION OF POST-HOLE, "L-SHAPED BUILDINGS."

One of the most interesting episodes of the exploration was the search for "Haverfield's Posts." Mr. Haverfield had called attention to the similarity of these Gellygaer buildings to some at Chesters (Fig. 13), and to the circumstance that in front of the set-back wall of each of the latter were the remains of a colonnade in line with the advanced wall of the wider portion. It was some time before indications of corresponding features were discovered at Gellygaer, and these were so vague that they would never have been observed had they not been specially sought. The pillars had been of wood, and, of course, had completely disappeared, but the holes in which they were fixed remained. These were, roughly, 18 ins. in diameter and depth,

and in them the posts had been packed round with stones, a flat stone occasionally serving as a foundation (Fig. 14). A sufficient number of the post-holes of Block XV. were first cleared out to show that there had been nine posts, nearly 10 ft. apart, forming a verandah about 6 ft. wide. Then trial holes were dug on the presumed sites of corresponding pillars in Blocks XII., XIII., XIV., and XV., the expected indications being found in each case. Blocks I. and II. were not examined for this purpose, but it may be assumed that they would have given the same results.

It has been mentioned (page 51) that the "long" buildings at Housesteads and Chesters were divided into small rooms. This was not the case at Gellygaer, but there may have been divisional walls of wood which have disappeared. These buildings divided thus into apartments, with the larger head, recalls the arrangement of tents in the Hyginian camp. According to Smith's *Dictionary* (article *Castra*), a normal row of ten tents accommodated a century, which, at the time of Hyginus, consisted of eighty men. The length of the row was 120 ft., and the centurion's space was equal to that occupied by two tents. Usually two such rows were placed face to face with a space between, forming the *striga*, while the *hemistrigium* consisted of a single row.

It is interesting to note that the Chesters buildings and two pairs of those at Gellygaer are placed *affronté*, and so may be well described as *strigæ*. It is still more interesting to note that there are *six* of these L-shaped buildings at Gellygaer, and that an ordinary legionary cohort contained *six* centuries; but whether the garrison there was a legionary cohort is uncertain.

Very little can be said about the remaining "long" buildings at Gellygaer. As no two of them agree in shape and size, it is likely enough that they were used for different purposes. As in the preceding, the walls were too much destroyed for door thresholds to remain.

Block III. This building, 114 by 27 ft., was divided into three approximately equal apartments, which, to judge from the results of the two longitudinal trenches by which they were explored, were used as workshops. In the north corner of the

N.W. room was a heap of finely-broken brick, probably intended for concrete. This was evidently broken on the spot, for towards the west corner were many large pieces of brick. Hereabouts, the floor of the room was vague, apparently of gravel, but towards the other end it was well defined, consisting of several inches of gravel on a pitched foundation. In the middle room, a layer of yellow clay and two thick patches of charcoal and burnt earth were cut through. The S.E. room had no definite traces of a floor except towards the south corner, where was a patch of kidney-stone pitching. In this room two blocks of stone, which had been used for sharpening knives or tools upon, were found.

Block IV. Here we have an irregular building 149 ft. long, and divided into four rooms of which the two in the middle are the smallest, and are of equal size. These rooms disclosed a gravel and rubble floor, which showed signs of having been concreted. The interior of the large room towards the N.W. was not trenched. The only thing remarkable about the large S.E. room was that it contained two enclosed spaces or rooms. The smaller of these—12 ft. by 7 ft. (internal)—was in the west corner, and the larger—14 ft. by 8 ft. (internal)—adjoined this, and was built against the S.W. wall, the main wall of the large room constituting the contiguous sides of the included spaces, the remaining sides being completed by their own walls. These walls were about 15 ins. thick, and slightly above the old level, and were built of square and half-round bricks. As, however, only a single course of these remained, it was impossible to say whether they formed a lacing-course only, or whether the whole of the wall above had been of brick. Within these spaces, and resting upon the natural soil, was a layer of fine sandy loam, from 5 to 7 ins. in thickness, suggestive of a decomposed mortar floor. As these structures bore some resemblance to a reservoir or tank adjoining Block IX., which will be described shortly, they may have had a similar use. As many pieces of roofing-tiles were lying about, this part of the range may have been roofed with these tiles; but it is possible they were derived from the neighbouring Block VIII.

Block IX. was the largest of the "long" buildings, being

146 ft. by 40 ft. It was separated from Block XII. by an eaves-drop nearly 5 ft. wide, which towards the N.W. end was contracted by a row of upright flags into a descending channel of about 16 ins. in width to facilitate the removal of the drip from the roofs into the drain of the adjoining street. Of the interior of this building nothing further can be said than that it was divided longitudinally by a wall upon a shallow foundation, the diagonal trenching which covered the site being singularly devoid of results.

Attached to the S.E. end of the lower division were found the remains of a well-constructed reservoir or tank, 20 ft. long by 7 ft. 6 ins. wide, the floor of which was about level with the



FIG. 15. LEAD PIPE FROM TANK, BLOCK IX. ($\frac{1}{2}$).

street. The end of the building formed its one side, and a wall from 14 to 15 ins. wide enclosed it on the other three. This wall rested upon a foundation of coursed thin stones laid in loamy clay, and above the floor level it was constructed of the broken sides of large flue-tiles; but so little remained—three courses at most—that it was impossible to say whether the rest of the superstructure was of tile. The floor was of brick concrete lying upon several inches of gravel concrete, which, in its turn, rested upon a foundation consisting of an upper stratum of pieces of pennant closely packed on edge in a direction across the tank, and a lower of larger pieces similarly packed but running longitudinally, the total thickness of these different materials being about 20 ins.; and under all was a bed of clay. This clay was also carried up as a lining, 3 or 4 ins. thick, to the surrounding wall foundations. In the middle of the S.W. end of the tank was a lead outlet pipe, 2 ft. 8 ins. in length, still *in situ*, which, after passing through the wall, opened

into a covered drain that crossed the *Via Principalis* and debouched into the main sewer of that road. This pipe was made from a strip of lead, $9\frac{1}{2}$ ins. wide, and $\frac{3}{8}$ in. thick, bent into a cylindrical form until the two edges met to form a butt joint, when it was soldered. The end within the tank was flanged (Fig. 15).

Blocks X. and XI. These buildings were linked together by a short length of wall, and were separated from Block XIII. by an eavesdrop of irregular width. Practically nothing further can be said of them beyond what the reader may infer for himself from their plans. The first came within the area of diagonal trenching, but the trenches were refilled without notes being made of them, and the interior of the second was only trenched to expose a longitudinal wall upon shallow foundations.

Yard.—In the three most perfect plans of the British Roman forts—Housesteads, Birrens, and Gellygaer—it will be noticed that while the first has one open space, and the second none at all, the third has *two*. The smaller space, behind the *Pratorium* at Gellygaer, like that at Housesteads, is strictly an *open* space, whereas the larger one, between the *Pratorium* and Block VIII., has all the appearance of having been enclosed; in other words, of having been a *yard*.

The chief entrance to this larger space was from the *Via Principalis*, where an opening 18 ft. wide was found in the boundary wall, here recessed from the street about 7 ft. The original width of the gate is, however, uncertain, as the actual jambs had gone. The opening was flanked by a small chamber ($9\frac{1}{2}$ ft. by 8 ft.) on the side of the wall next the yard, apparently with a small door opening on to the track through the gate. The boundary wall was continued beyond this chamber to Block VIII., which formed the S.E. side of the yard, except for a passage between it and Block IV. On the opposite side of the yard to this passage, and in the wall between it and the lane along the side of the *Pratorium*, were some indications of another opening or gate. That this was simply a boundary wall was confirmed by its shallow foundation, barely 1 ft. deep.

Several trenches were cut in this yard, but they failed to supply any definite information; still they went to show that it was used for various purposes. In the western quarter they proved that the Roman surface was more or less gravelled, whereas in the northern quarter, the old natural surface always appeared in an undisturbed and clean condition, as though this part of the yard had never been in use. In the southern quarter there was no trace of gravel or rubble as a rule, but the lowness of the ground here necessitated a curved raised footpath which led to the angle between the large S.E. room of Block IV. and the neighbouring small room, where doubtless was a door. The path consisted of a series of large flag-stones on the summit of a low gravel bank.

In the angle between Blocks IV. and VIII., but about 8 or 9 ft. from each, was a well-laid oblong space, 17 ft. 6 ins. by 16 ft., of thin stones packed on end. It was taken at first for road-pitching, but the upper edges were not worn, and the broken stone and brick which lay upon it was suggestive of decomposed concrete. No trace of an enclosing wall was found.

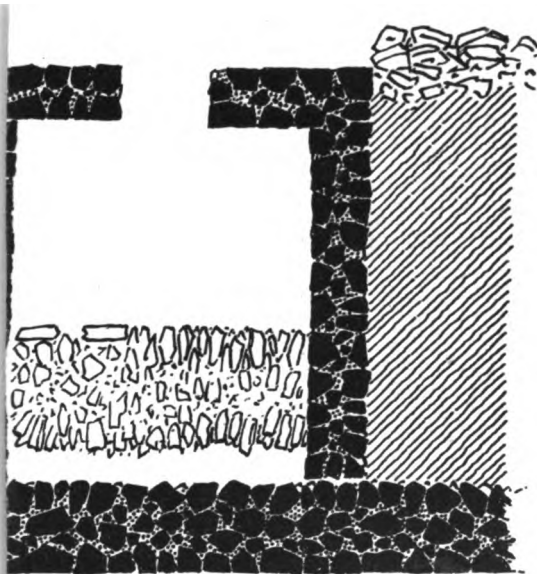
Towards Block VIII. the ground had been considerably raised, and along the side of that building, and for half its length, ran a pavement 8 ft. wide, composed of tabular pieces of stone of all shapes, not very closely placed together.

The eastern quarter contained some puzzling features—thick seams of carbonized earth; patches of clay, some burnt; fragments of walling constructed of thin stones, reddened by the action of fire, &c. Probably, if this portion of the yard had been more thoroughly explored, the remains of furnaces of some sort would have been brought to light.

More to the east, occupying, in fact, the angle between the lesser gate-chamber and the boundary wall, was the most interesting feature in the yard—a latrine. The plan on Plate IX. will make its details clear to the reader. The floor *a*, *a*, which appears to have been on the ordinary Roman level, was paved with carefully-fitted large flag-stones, of which the largest was 4 ft. in length. Three inches from its S.E. edge ran a hewn-out half-round gutter, 22 ft. long and 5 ins. in width. This, at its lower end, drained into the sunk channel *b*, which ran parallel with the

edge of the pavement at a distance of about 9 ins. from it. Its carefully-paved descending bottom, 10 ft. long, and 14 ins. wide, passing through an opening in the boundary wall, was continued by a covered drain to the sewer of the *Via Principalis*. One of its walled sides, which gave support to the edge of the pavement above, remained, but the opposite side had entirely gone. The flag-stones of the pavement were much displaced. They had scarcely any signs of wear.

Between the latrine and Block VIII., and close by the latter, the boundary wall was pierced, apparently for the passage of a drain. The opening was about 2 ft. wide and 2 ft. 6 ins. high. If such a drain existed, its remains were probably removed during the course of the excavations, which were here carried about 2 ft. 6 ins. below the Roman level.

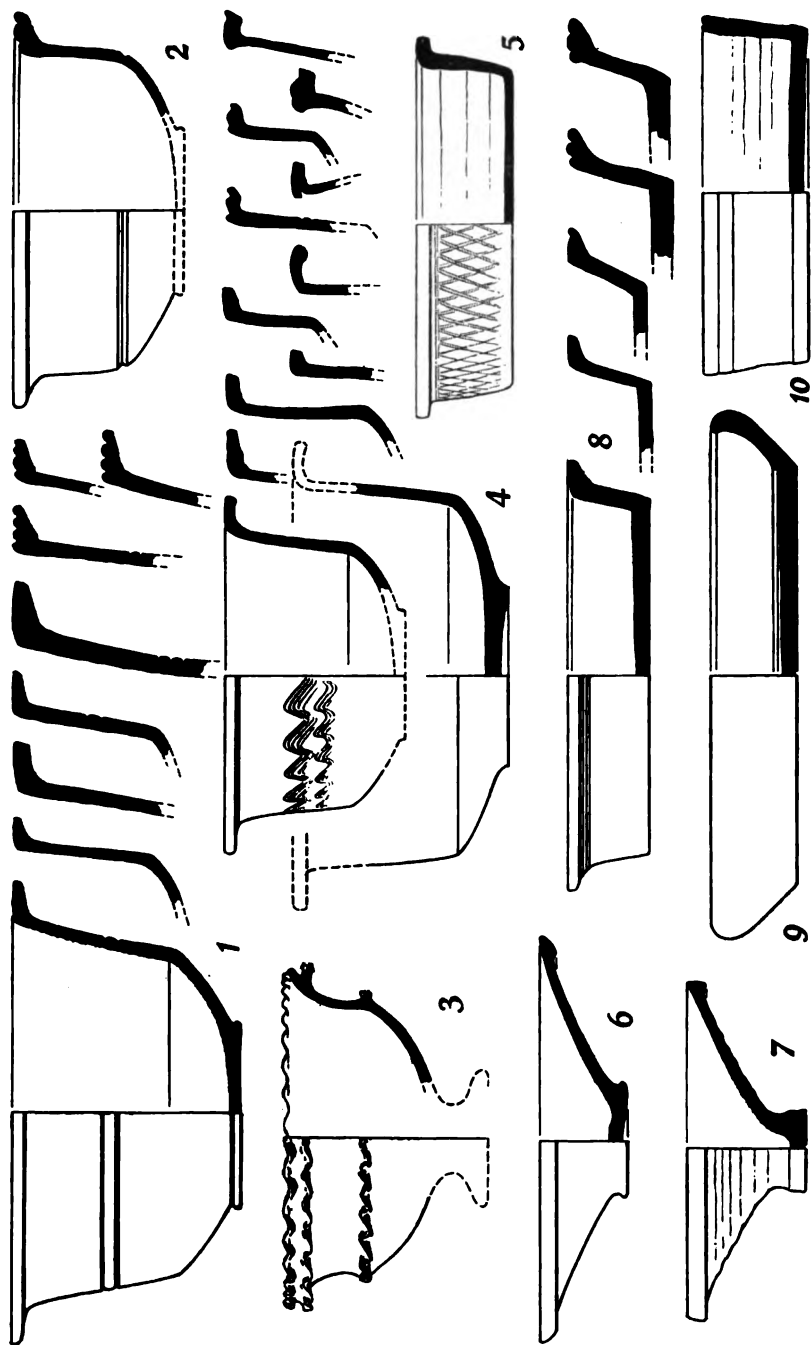


AN OF TOWER

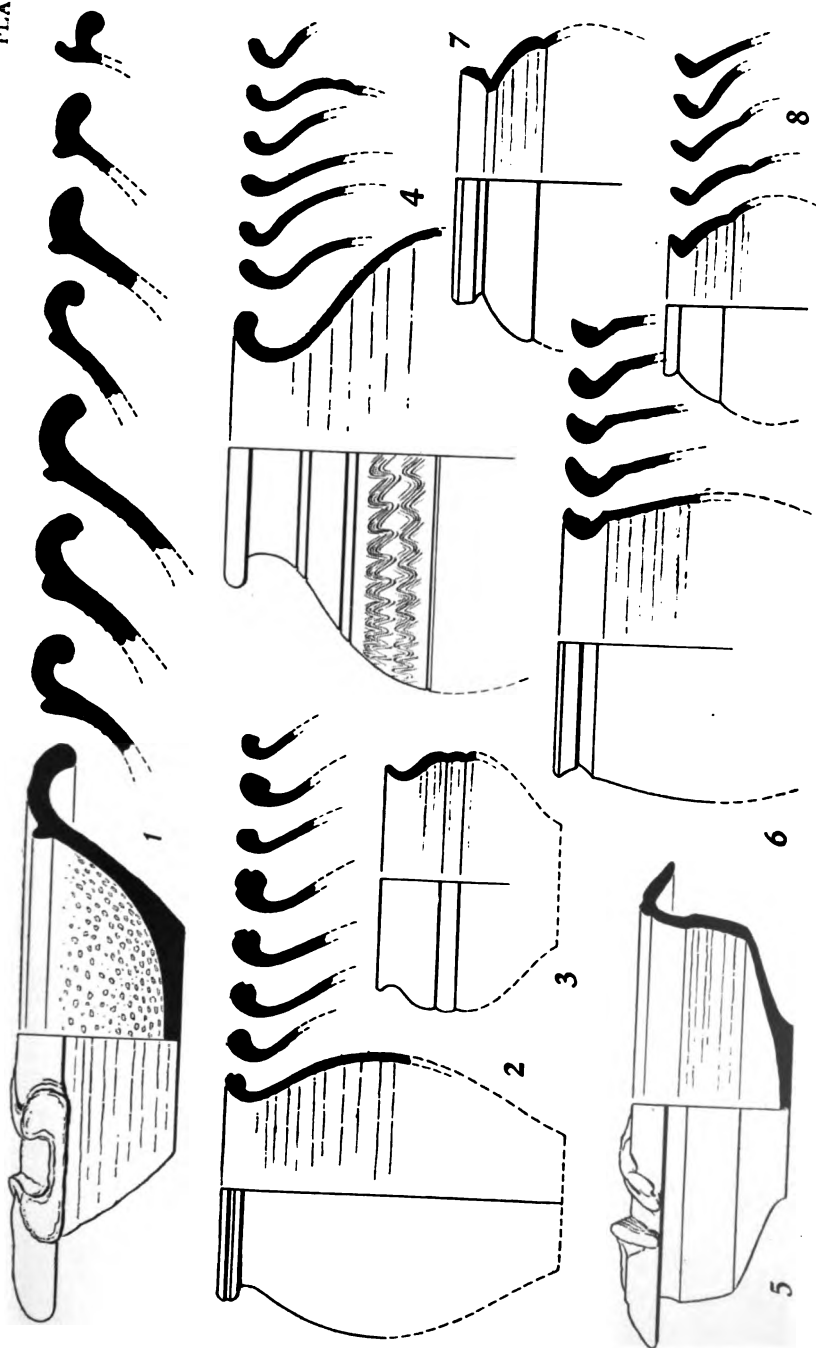


TANK IN PRAETORIUM

J. Ward. Mens. et Del.



THE POTTERY: TYPES OF VESSELS.
(All one-quarter size of Originals.)



THE POTTERY: TYPES OF VESSELS.
(All one-quarter size of Originals.)

SECTION VII.

Notes on the 'finds.'

ALTHOUGH the chief end of the exploration was the recovery of the plan, it must not be supposed that the miscellaneous objects of human workmanship, other than building materials, were neglected; on the contrary, the men were instructed to keep a sharp look-out for them, and to save all they found. These were deposited, at the end of each day's work, in a shed at the old School-house or in the Rectory coach-house; and by the end of the exploration there were several wheelbarrow-loads of 'finds,' mostly potsherds. The only fault to be found with this procedure was the mixing together of the objects, thereby rendering the task of sorting and piecing a practically insuperable task. We may accept it as a general rule that upon such sites as Gellygaer, the fragments of the different vessels will be near one another, so that if each day's discoveries, or better still, those of each trench, be kept to themselves, it will be comparatively easy to detect the fellow fragments among them, and thus the work of reconstruction—tedious enough under any circumstance—will be greatly facilitated.*

Taken as a whole, the Gellygaer 'finds' were of a commonplace order. This, of course, was not surprising; we must not look for the refinement and elegance of city and villa life in a military post in a newly-conquered territory. But even for a fort they were commonplace and lacked diversity. No altar or image, not even a bronze fibula or pin of Roman age, is recorded as having been found at Gellygaer. The coins

* I found strong paper bags very useful in the exploration of Rains Cave, Derbyshire. All the objects from each "foot-strip" were placed in one of these bags, which was then marked with the number of the strip, and reserved for future study.

discovered during the excavations were few, and most of the pottery was of the coarsest wares.

The collection, however, has an interest scarcely suspected while the exploration was in progress. If my conclusion that the fort was of short, and for Britain, of early occupation, is a right one, the Gellygaer 'finds' may prove to be an important factor in the chronological classification of objects, especially pottery, of Romano-British age. Mr. Haverfield, referring more particularly to the so-called Samian ware, has occasion to remark that while German archæologists, notably Hettner, Koenen, and Dragendorff, have rendered good service in this branch of Germano-Roman archæology, little attention has been given to it in this country (*Trans. Cumberland and Westmoreland Antiquarian and Archaeological Society*, Vol. xv., p. 191).

The soil of Gellygaer has had a deleterious effect upon many of the objects. Those of bronze have undergone chemical change throughout; those of iron are, as a rule, reduced to mere shapeless masses of oxide; and the pottery is generally in a soft condition* with the original surface removed by decay. The glass, on the other hand, is singularly fresh. Why the soil should have had this effect, I cannot say. At Caerwent the order is reversed; the pottery has suffered little, and the glass much. At Melandra Castle I was struck with the freshness of both.

The Pottery.—No perfect vessel was found, nor has it been possible to build up a complete one from the fragments. Fortunately, however, in many instances a sufficient sequence of pieces has been recovered to render it possible to determine the original form and size of the vessel. It is also possible by comparing these partial restorations with one another and with the multitude of loose fragments, to re-construct all the commoner types of vessels used at Gellygaer, and to roughly estimate their relative numbers.

The pottery, with few exceptions, falls into the three following classes:—

* All the potsherds which have been retained as specimens have been hardened by immersing them in a bath of hot gelatine size.

- (1) Coarse yellowish wares, consisting mainly of the heavy and bulky *amphora* and *dolia*, and of the largest *mortaria*;
- (2) Common red, grey, and black wares, relating to a large number of varied, but smaller vessels; and
- (3) The so-called "Samian" ware.

This classification, based essentially upon the wares, applies with almost equal force to the forms, for the vessels of each class, though diverse among themselves, have little in common with those of the other classes. As descriptions alone of pottery are of little real service, I have figured, one-quarter full size, on Plates X., XI., and XII., typical examples of the different forms found at Gellygaer, after a German manner, each figure presenting at once an elevation of the exterior and the interior, and a section of one side. These drawings may not have the pleasing effect of the usual perspective views, but they have obvious advantages.

Of the first of these classes, the fragments of the great two-handled *amphora*, used for storage purposes, were the most numerous, the more globular *dolia* being represented by only a few pieces. The potsherds of this class were so decayed that it was impossible to make out the exact shapes and sizes of the vessels to which they appertained. They were mostly of a soft, gritty, yellowish clay, which became brittle upon drying; but a few pieces had a reddish tinge, and were harder. The handle of one of the *amphora* bears the potter's name in raised letters in a sunk label, apparently CEFK or CEFN.

The potsherds of the second class are not only the most abundant, but are the most interesting, for they represent the ordinary kitchen and table utensils of the fort. In a villa, these would be confined to the kitchen, but at Gellygaer the vessels of finer wares, to judge from the fewness of their fragments, had a very limited use; probably they were not seen outside the officers' quarters.

One-half, or more, of the potsherds of this class are rather coarse, ranging from a dirty salmon colour to a dull brick-red, many of them so closely resembling one another as to suggest a common origin. The original surface has generally been

removed by decay; but where it still remains, it resembles that of our modern flower-pots. The rest of the potsherds of this class relate to thinly built vessels of the common grey and black wares, but they vary considerably in texture and appearance. Some are of a slatey-grey colour, soft, and much decayed; but those pieces which are decayed usually exhibit a carefully smoothed surface, retaining patches of the original black film. Others are harder and browner, of a fine gritty texture, and as a rule better preserved than the foregoing, but their surface-coloration appears to be simply that of the paste, and not to be due to a film.

The commoner vessels of the class we are now considering were fabricated in both varieties of ware; but each series—those of the red wares on the one hand, and those of the grey and black on the other—had certain peculiarities of form which suggest a difference of manufacture. One of the commonest forms was a bowl with upright sides, springing from a saucer-shaped bottom, and crested with a flanged lip. No. 1, Plate X., is typical of the red-ware series, and the sections on the right-hand illustrate the chief variations. These vessels ranged from 6 to 15 ins. in diameter. The larger were often ornamented with a single or double sunk bead round the middle. The upper surface of the lip was usually plain, but was occasionally reeded or otherwise moulded. No. 2 represents a form in which the transition from the lower curve to the sides was less abrupt.* The grey and black equivalents (No. 4) of these vessels were more thinly built, and the drum more cylindrical. None of these had the sunk-bead string, but occasionally in the corresponding place was a wavy pattern, produced by holding, with an oscillating movement, a toothed tool against the vessel when slowly revolving on the wheel. One or two of the sections at the extreme right seem to relate to vessels of a more globular shape.

A considerable number of fragments belong to flat-bottomed or tray-like vessels, which, for want of a better name, I will term dishes. No. 8 represents the prevailing form in the red-ware

* A bowl like No. 1 may be seen in the York Museum; and some like No. 2 have been found at Haltern in Westphalia, *Mitteilungen der Altertums-kommission*, Heft II.

series. These ranged from 6 to 10 ins. in diameter, with flanged lips like those of the bowls. Of the corresponding black-ware dishes, fragments of only two were found, one of which is shown in No. 5. Both were decorated with a trellised pattern of burnished lines on a dull ground. No. 9 is a dish of another type, of which six or seven examples are represented in the potsherds, varying from 9 to 12 ins. in diameter. The fragments of that figured are of a brownish colour, finer than usual, and well preserved. Of similar paste, except that it is minutely flecked with some glistening substance, probably mica, are the fragments of the curious dish with vertical sides, No. 10, the only one of the shape found.

On the same plate are shown (Nos. 6 and 7) two shallow vessels, the one in common red and the other in a dingy black-ware, each upon a raised foot. Of the former type, fragments of about seven were found, ranging from 7 to $9\frac{1}{2}$ ins. in diameter; of the latter, only one.

The familiar jar-like vases with bulging sides and graceful out-curved lips, were as plentiful as the bowls above described, but unfortunately not one can be completely restored. Most of them were of grey and black wares, and they varied considerably in size and shape. No. 4, Plate XI., presents a typical series, varying from 5 to 8 ins. from lip to lip. The largest of these (of which only the upper portions were found) was ornamented with two or more bands of the incised wavy pattern. A few of these jars had short abrupt lips, as shown in No. 8. The solitary example, No. 7, seems intended to receive a lid. It will be observed that some of these grey and black-ware jars, especially the smaller ones, had one or more horizontal undulations or convexities, as may be especially noticed in No. 3. The fragments of these are, as a rule, of the dark brown variety of the ware.

The less numerous red-ware examples of these globose pots were about equally divided between the two types shown in Nos. 2 and 6. In the one, the lip was boldly rounded, sometimes grooved outwardly or on the summit; in the other, the shoulder was angular, and the lip cornice-like, approaching the form of an ogee moulding. The fragments of the latter were

generally found discoloured with soot, as also some of those of the red-ware bowls and dishes, showing that these vessels were at least sometimes used for warming or cooking food. Fragments of red-ware jars of these two types, derived from Scottish Roman forts, are to be seen in the National Museum of Antiquities, Edinburgh; but Dr. Anderson informs me that, as with us, it has not been possible to restore a single vessel. Apparently they were tall, the first type ranging from $4\frac{3}{4}$ to 9 ins., and the second from $3\frac{1}{2}$ to $6\frac{1}{2}$ ins. from lip to lip.

As might be expected, many fragments of that most characteristic of Roman vessels, the *mortarium*, were found at Gellygaer. They all belong to one type—that in which the rim consists of a wide rounded outer member with an inner bead or fillet, as illustrated by the series of sections in No. 1, Plate XI. It is doubtful, however, whether the last of these sections relates to a *mortarium* at all; and it may be added that the fragment that supplied this section is of a fine pale buff ware, the only example of the sort found on the site. With one other exception—a piece of an unusually large *mortarium* in the coarse ware of the *amphora*—the fragments of these vessels are of the ordinary red ware, but of varying degrees of coarseness. These red-ware *mortaria* ranged from 10 to 15 ins. in diameter, and as far as can be judged from the fragments, the hard material used to stud the inner surface to promote the process of trituration, was broken quartzite pebbles. The absence of the steep band-like form of rim from Gellygaer should be noted.

While the curious vessel (of which fragments of one only were found) shown in No. 5, approaches the *mortarium* in form, it is of too slight a build to have served the same purpose, and the absence of quartz “teeth” tends to confirm this. It is of common black ware, and the simple manner in which a spout has been provided by the planting of two clay cheeks upon the rim is well shown in the drawing.

Several black-ware rims have the sections shown in No. 11, Plate XII. These appear to have belonged to flat-bottomed vessels with straight sloping sides, as indicated by the broken line—a form of vessel often found on Roman sites. On the same plate is shown an unusual saucer-like vessel, No. 13, the

only one found. It is of a dirty salmon colour. The fragments from which Nos. 12 and 14 are developed seem to relate to similar vessels. On this plate is also shown the upper portion, No. 10, of a large red-ware vessel, with a contracted mouth and flat-reeded lip. The general shape appears to have been somewhat globular, but it is impossible to say with certainty.* A fragment of a similar vessel, but with a reeded shoulder, was also found. To the right of the figure is shown the somewhat different upper section of another large vessel of a very hard and gritty brownish ware.

No. 3, Plate X., represents the bowl of a "frilled" tazza, the only example found at Gellygaer. The "frilling" was produced by the alternate pressing up and down of the thin flange-like fillets while the clay was soft. Similar vessels may be seen in the York and the Guildhall Museums, and a portion of one has been recently found at Caerwent; but the York examples most closely resemble ours, both in their manipulation and the brick-red colour of their paste. All the perfect ones that I have seen are on raised feet, as indicated in the drawing.

The fragments of the few jugs—perhaps six or eight in all—fall well within the second class, but they differ considerably in texture and colour. The spoutless bottle-like neck of one, horizontally ribbed, is in a hard, gritty, cream-coloured ware. Another, with a spout, and closely resembling that shown in Fig 2, Plate XL., of Pitt-Rivers' *Excavations in Cranborne Chase*, is in a pale red ware. These relate to comparatively small jugs, probably not more than 9 ins. high. Two large red-ware fragments belong to pitcher-like jugs, with mouths from 4 to 5 ins. in diameter. All the handles are of the flat, grooved form, except one, which is round in section. A piece of a small jug is of fine red ware, washed externally with cream-coloured clay; similar jugs have been found at Silchester and other places.

The pottery of the third class—the well-known Samian or "sealing-wax" ware—now demands attention. On Plates XII. and XIII. are shown all the types of vessels of this ware, which have been developed from Gellygaer fragments. Taking them in the order in which they appear on the plates, we have, first, the

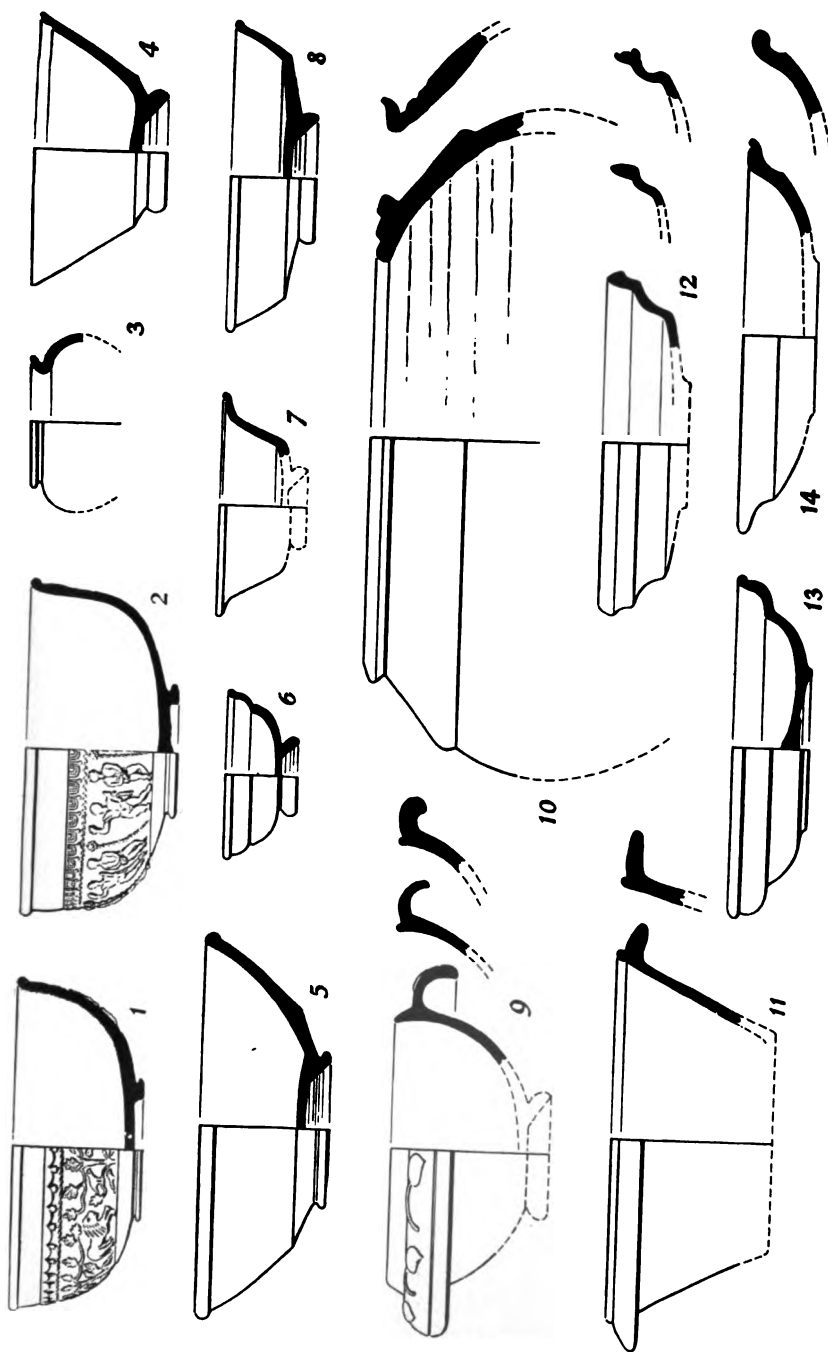
* Fragments of similar vessels have been found at Haltern, Westphalia.

decorated bowls of the common, shallow, hemispherical form, of which the two most perfect are shown in Nos. 1 and 2 of the former plate. The one depicts a forest scene: various animals, as lions, boars, and deer occupy the ground, while above, are birds amid the spreading foliage of what seems to be sycamore. The usual band of festoon-and-tassel ornament is, in this case, more realistically treated than usual. The other vessel is a little deeper. The sides are divided into a series of four-sided compartments, in each of which is repeated two nude male figures, the one apparently a captive with his hands tied behind his back, and the other in the attitude of striking him. One of these compartments is shown on a larger scale on Plate XIII., No. 5. A figure which occurs on a Samian bowl found at Rushmore Park, Wilts. (Plate XLI., *Excavations in Cranborne Chase*), so closely resembles the latter—the striker—as to suggest that both came from the same mould; it is, however, there associated with a different figure from its companion on the Gellygaer vessel.

On Plate XIII. are shown a number of decorated fragments (Nos. 1 to 15, *less* 5) relating to four or five other bowls of the above type. They call for no special comment, except that No. 6 closely resembles a fragment found at Caerleon (Plate XV., 2, *Isca Silurum*).

On the same plate is shown (No. 1) the fragment—the only one found*—of a small bowl of a different type, one with vertical sides. The piece unfortunately is not large enough to allow of the entire form of the vessel being made out, so I have conjecturally restored the upper and lower portions from other sources. The occurrence of this form of Samian bowl at Gellygaer is of great interest, for its period has been determined with some degree of certainty. The German archæologists have shown that it is rare on those Roman sites in their own country which have a later origin than the closing decades of the first century, A.D.; and Mr. Haverfield has recently given some good reasons for assigning a similar date to its disappearance in Britain (*Trans. Cumberland and Westmoreland*

* Since the above has been in type I have detected a small piece of the lip of one of these bowls, probably the bowl described, among the fragments from Gellygaer.



THE POTTERY: TYPES OF VESSELS.
(All one-quarter size of Originals.)

Antiquarian and Archaeological Society, XV., 191). He points out that the chief recorded sites on which these bowls have been found—such as London, Richborough, Silchester, Bath, Charterhouse, Caerleon, and York—"were certainly occupied by the Romans before about A.D. 85"; whereas they have been less often found on those of later origin, as the forts of the Wall and of Scotland. To Mr. Haverfield's list may be added Caerwent, Wilderspool (Warrington), and, of course, Gellygaer.

The other types of Samian vessels found at Gellygaer are shown on Plate XII. The little globular jar, No. 3, is represented by only a single fragment of the upper portion. There are potsherds pertaining to two such basins as No. 4, to five cups of the graceful form of No. 6, and to six or seven of the saucer-like vessels indicated by No. 8; while one only of the large basin, No. 5, and one of the diminutive basin, No. 7, are represented.

No. 9 represents a form which differs from all the foregoing in having a curved overhanging rim or flange, the use of which may have been to receive the frame of a supporting tripod as suggested by General Pitt-Rivers in *Excavations in Bokerley Dyke and Wansdyke*, p. 144. The fragments being insufficient, I have had recourse to more perfect vessels of the form found elsewhere for my drawing. The only decorated part is the upper surface of the flange, the simple bossy conventional foliage of which harmonizes well with its rounded surface. Fragments of two other similar vessels, shown in section in the same figure, were also found, the second apparently being quite plain.

A small number of potsherds indicate that the garrison possessed a few vessels which do not fall within the above classes. A fragment having a section similar to that just mentioned is of a fine pale red paste, superficially washed with a dark red pigment, with signs of having been polished. Several decayed fragments of bowls appear to be of the same ware. Two pieces of decorated vessels, one shown in No. 16, Plate XIII., and the other, part of the curved flange of a similar cup to No. 9, Plate XII., differ from typical Samian ware in being darker and lacking the enamel. They are extremely fine in texture, and the surface appears to have been polished.

Fragments of two, if not three, small, tall vases with thin, swelling sides, are of the ware usually attributed to Castor, buff and salmon coloured, with dark "rough-cast" surfaces. A fragment of a globular jug, and of the rim of a large mortarium, are of rather coarse red-ware, the one with a light buff, and the other with a fine brick-red wash. A solitary potsherd of a greyish ware was covered, when found, with a fine soft veneer of the same colour, which was unfortunately removed in cleansing. Steatite, apparently, entered into the composition of this veneer, for it had a soapy feel. It was decorated with incised concentric circles, from which depended vertical bands of three lines each. A vessel of the same build and shape—a tall cylindrical bowl with a saucer-like bottom—has recently been found at Caerwent.

It was formerly supposed that the Romans were unacquainted with vitreous glazes, but of late years a few undoubted examples of their pottery covered with lead-glaze, have been discovered, notably a bowl at Silchester, figured in *Archæologia*, Vol. LV. While it is evident that this ware was uncommon, it may have been less so than we suppose, as it is easily mistaken for medieval. At Gellygaer, as on other Roman sites, potsherds of later periods than the Roman, were found. A few of these have the lead-glaze so characteristic of the pottery of medieval and later times, but I am inclined to regard one of them as Roman. It is the upper part of a small globular jar, closely resembling No. 3, Plate XI., only relatively taller. The glaze is of a rich yellow-green colour, overlying a black body. In looking over a number of medieval potsherds found in the Caerwent diggings, I noticed one which resembled it, and belonged to the lower part of a similar vessel, which had vertical "pillars" at intervals round the belly.

We cannot safely determine the relative numbers of vessels of all types used in the fort, from the potsherds which have been secured from the exploration; for it is reasonable to think that the *amphora* and *dolium* fragments from their largeness, and the Samian fragments from their brightness and obvious excellence, were more frequently observed and saved than were their fellows of the second class. But if we eliminate those potsherds, we may rely upon the large residue to give

some idea of the relative numbers of the commoner vessels of the second class. The following list must only be regarded as a rough approximation :—

Bowls, as Nos. 1, 2, and 4, Plate X.; red-ware predominating	...	...	...	...	26 per cent.
Jars of the grey and black-ware types, as Nos. 3, 4, 7, and 8, Plate XI.	...	...	...	...	18 „
Jars of the two red-ware types, Nos. 2 and 6, Plate XI.	...	...	...	...	16 „
Mortaria; all of buff and red-wares, No. 1, Plate XI.	...	...	...	...	20 „
Flanged Dishes, as Nos. 5 and 8, Plate X.; mostly red-ware	...	...	...	...	8 „
Dishes, as No. 9; Plate X.; all red-ware	...	...	...	...	4 „
Saucers, as No. 6, Plate X.; mostly red-ware...	...	...	...	...	8 „

100

Glass.—Of the broken glass of various ages found during the exploration, those fragments (forming the larger proportion) which are undoubtedly Roman, are in a singularly fresh condition, contrasting in this respect with the fragments of thin green window-glass and of the thick dark bottles of a century or more ago, which in most instances have been excessively filmed by the action of the soil. The Roman glass, of course, alone concerns us here.

The window-glass has already been referred to (page 29). Of the same blue-green glass are the fragments of seven or eight large bottles with necks varying from about 2 to 3 ins. in external diameter. Most of these bottles were cylindrical, and one at least was square and, unlike the others, moulded; while all had flat handles bent at a right angle, and attached to the shoulder and the neck, the lower portion being reeded. The upper portion of one of the cylindrical bottles is, to some extent, restored from the pieces; it is $6\frac{1}{4}$ ins. in diameter, and the sides are thin and highly transparent. A fragment, apparently of the bottom of the square bottle, has a cast pattern of interlacing circles.

Of the same blue-green glass is the "frilled" pillar of a pillared bowl, with the fragment of a "frilled" lip and a ring-base of apparently the same vessel. Of a finer quality of glass, are several pieces of two hollow rims, one belonging to a cup with a wide out-spread lip.

The upper portion of a thin beaker or goblet of colourless glass well illustrates the skill of the Roman glass-worker. The lip of this vessel was gently curved outwards, the diameter from lip to lip being 3 ins. The external surface of the fragment is decorated with horizontal grooves $\frac{3}{16}$ in. in width, one immediately below the lip, a band of three a little lower, and below this a band of two. The grooves have evidently been ground out on the lathe. The inner surface of the vessel is perfectly smooth, but the outer has undergone some process (probably chemical) by which it has received a fine glistening frosted appearance, and this process was subsequent to the grooving. Two fragments of other vessels—one of a greenish hue—exhibit the same peculiar surface. Similar goblets to the above have been found at Caerwent and Lyne.

A fragment of a thick vessel of crystalline glass with a faint yellowish tinge has its outer surface diapered with incuse ovals, each about $\frac{7}{8}$ in. in length. My first impulse was to reject it as a fragment of a modern glass sugar-basin; but as pieces similarly decorated have been found on other sites, as London, Birrens, Wilderspool, etc., I forwarded it to Dr. Anderson, who submitted it to a manufacturer, and reported as follows:—"The glass manufacturer to whom it was shown does not think it is modern glass. This is all he can say as he is not an expert in Roman glass. But it seems to me to confirm the attribution of it to the Roman period. We have (as you know) a similarly cut beaker from Birrens, and from Ardoch we have a fragment (broken into very small pieces) which has the same kind of cutting, and the body of the glass is about the same thickness as yours, the Birrens one being thinner. The presumption, therefore, is both on the negative and positive lines that your specimen is of the Roman period."* By the courtesy of

* Since writing the above I have found a similar fragment classed as modern in the temporary museum at Caerwent.

Dr. Anderson, the London and Birrens examples are here illustrated.

Six small button-shaped discs of glass were found. Of these, three black and two of a greyish-white are about $\frac{5}{8}$ ths in. in diameter, and were evidently made by pouring a small quantity of melted glass upon a slab, so that while the upper surface is convex and shining, the lower is flat and dull. The sixth is larger, of a deep grey, and double convex. Such discs are frequently found on Roman sites, and occasionally their upper surface has five dots of coloured enamel. Various suggestions

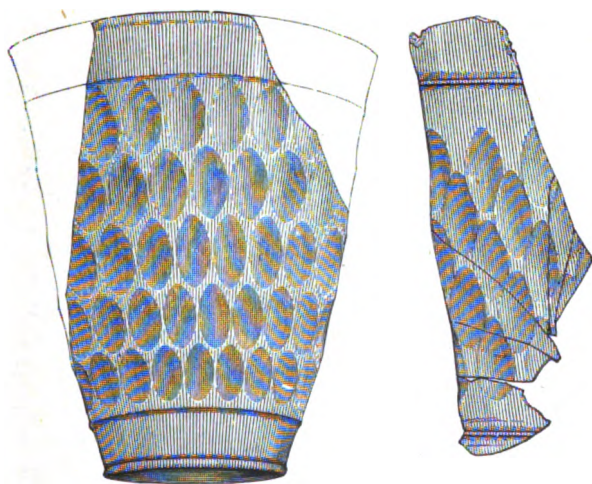


FIG. 16. GLASS BEAKERS FROM LONDON AND BIRRENS.

have been made as to their use, the most probable being that they were used as counters in some game.

One or two small ribbed melon-shaped beads, common enough on Roman sites, may be mentioned here. They are of a blue-green frit-like paste, less than $\frac{1}{2}$ in. in length.

Objects in Lead.—On Plate XIII. is figured (No. 17), full size, a disc of lead, found during the first year's diggings. It is faintly impressed on the one side with a marking resembling the letter M, and on the other with a shield-like panel, containing

a cross and pellets. It has been suggested that it is a Roman tessera, and several similar objects, supposed to be Roman, may be seen in the Blackgate Museum, Newcastle-on-Tyne; but there can be little doubt that it is medieval. On the same plate are also figured, half size, a plumb, or, possibly, the weight of a steel-yard; an altar-like pedestal with a square tenon; and the lower part of a lamp-stand (Nos. 18, 19, and 20). This stand is trefoil-shaped, with the remains of vertical sides and a coiled-up handle. It is apparently of cast lead, about $\frac{1}{8}$ in. thick. A similar stand was found at Wilderspool, and is figured in



FIG. 17. IRON IMPLEMENT: A MATTOCK? (1).

Mr. Thomas May's paper upon the excavations there, read before the Historic Society of Lancashire and Cheshire, 1900. Several may also be seen in the York Museum.

Besides the above, there were found a spindle-whorl, $\frac{3}{4}$ in. in diameter, neatly cut into shape out of a piece of thick lead sheet; a roughly circular mass of lead with a flat top and bottom, nearly $1\frac{1}{2}$ in. in diameter, and $\frac{1}{2}$ in. in thickness*; several pieces

* When at Melandra Castle in 1900, I was shown a number of similar masses of lead, but of different sizes, obtained from the excavations there.

of sheet lead, one a long thick strip with the narrow end doubled over as if to form an improvised plumb; and a ball of lead, $\frac{1}{2}$ in. in diameter, probably not Roman, as it appears to have been cast from an old-fashioned bullet mould.

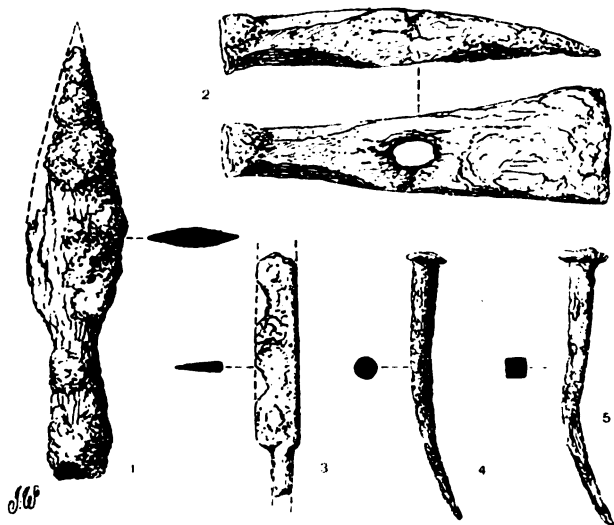


FIG. 18. IRON OBJECTS: SPEAR-HEAD, KNIFE, HAMMER, AND NAILS. ($\frac{1}{3}$).

Iron Objects.—The majority of the iron objects are mere shapeless masses of oxide, and of the residue many are obviously of more recent date* than the Roman Occupation. The most remarkable of those which can be safely regarded as Roman from their condition, is the implement shown in Fig. 17, apparently a mattock, or an adze. The blade is $7\frac{1}{2}$ ins. long by $2\frac{3}{4}$ ins. across its widest part. In the socket are still the remains of the handle, about 1 in. in diameter, and apparently of ash. Iron mattocks have been found at Camelon, Ardoch, and upon other Roman sites, but these lack the elongated socket of the Gellygaer example.

* For a few examples of these, see page 94. Among the iron objects of uncertain age, may be mentioned several horse-shoes.

In Fig. 18 are shown, half size, the following:—a socketed spear-head, the only one recognized as such among the iron 'finds'; part of the blade of a thick narrow knife; a hammer-head with a transverse cutting edge; a round spike, and a square nail. It is doubtful whether the hammer is Roman. I am told that it is very similar to a form still used in some parts of South Wales in the preparation of stone roofing-flags. The nail is typical of its class at Gellygaer, where they have tabular heads,

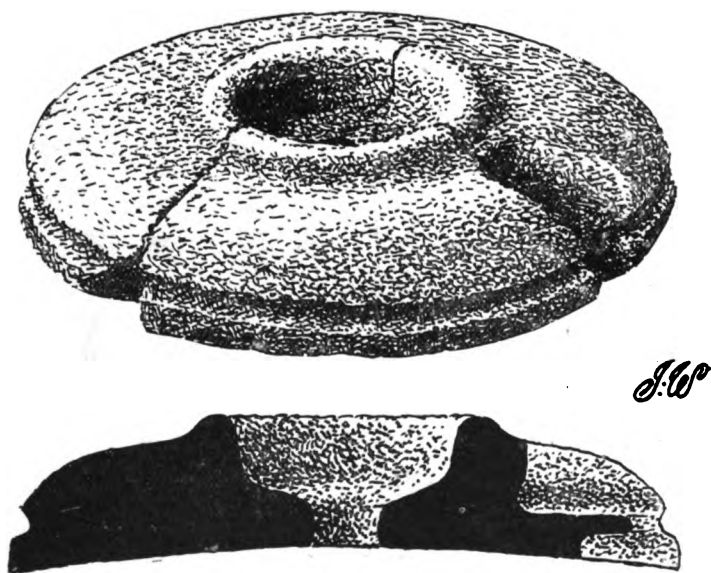
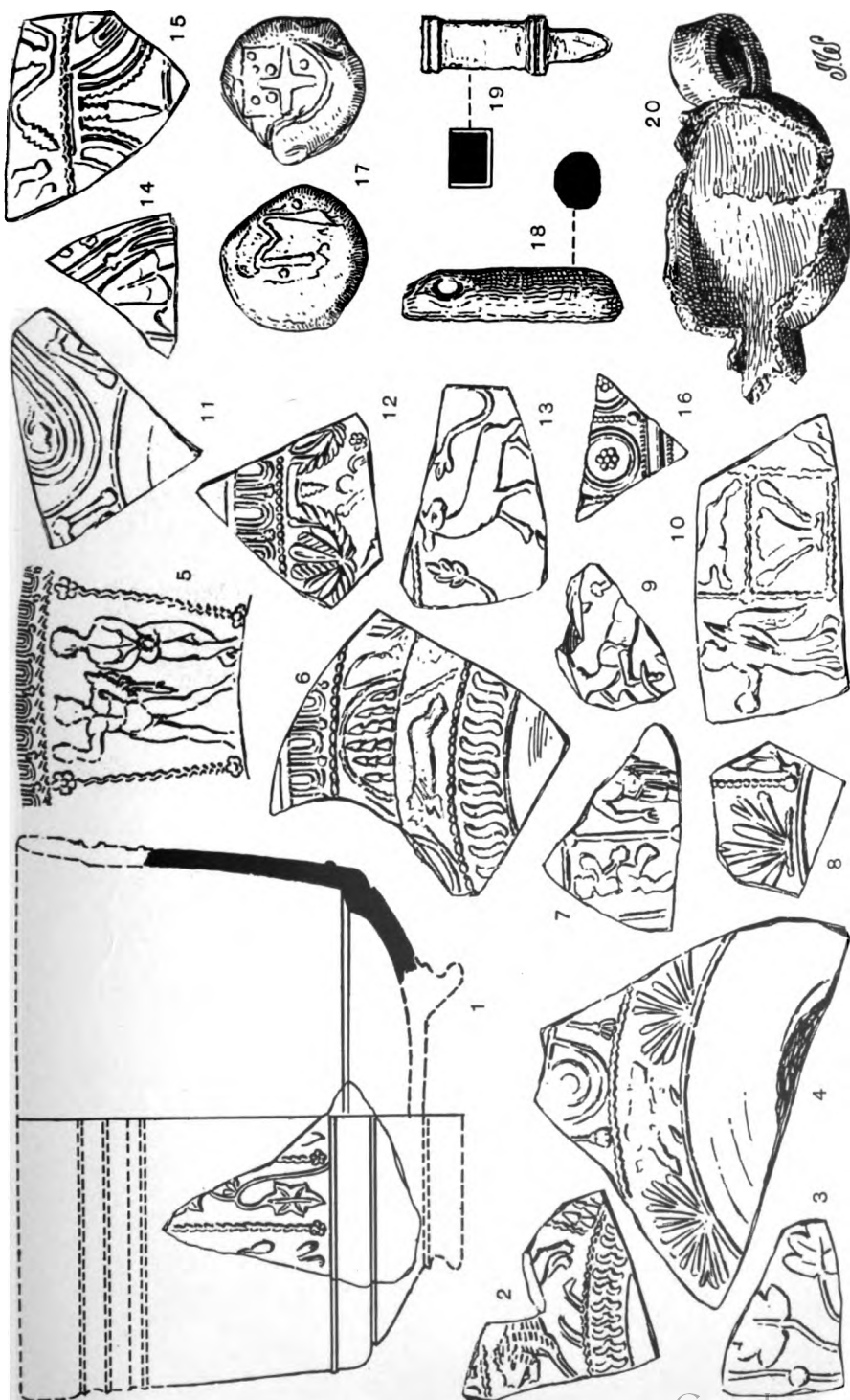


FIG. 19. UPPER STONE OF QUERN AND SECTION. (APPROX. $\frac{1}{2}$).

and vary from 2 to 4 or 5 ins. in length. Besides these, several rings of various sizes, staples, a portion of what may be a centre-bit, etc., were found.

Stone Objects.—The upper stone of a quern, shown in Fig. 19, is of millstone-grit, 15 ins. in diameter, neatly wrought into shape by "sparrow-pecking." The central hole is expanded above into a dish-like hollow with a raised rim to serve as a hopper. The stone was found broken into three pieces.



ORNAMENTED SAMIAN POTSHERDS AND OBJECTS IN LEAD.

(All half size of Originals, except No. 17, which is full size.)

and this breakage is ancient, for the groove round the periphery, which is well seen in the drawing, was evidently introduced to receive a band of some kind to hold the pieces together. The handle-socket seems to have been altered at the same time.

The fragment of a lower stone, also of millstone-grit, was found, but it belonged to a larger quern than the above.

Fig. 20 is a portion of a shallow mortar of a hard igneous rock. In its complete condition it was about 18 ins. in diameter, and had several—apparently three—projecting lugs. Stone mortars of this type frequently occur on Roman sites. One,

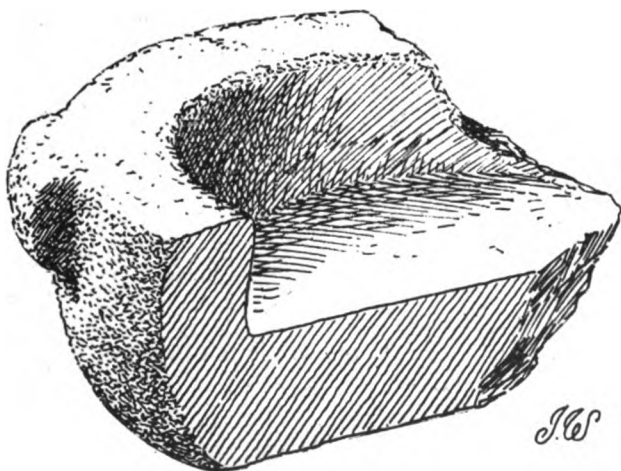


FIG. 20. FRAGMENT OF STONE MORTAR. (APPROX. $\frac{1}{2}$).

almost identical with this Gellygaer example, was found by the writer at Little Chester, Derby, in 1889; others are figured by General Pitt-Rivers.

Many whetstones of different sizes were met with during the exploration. The larger number were of fine-grained pennant-grit, the rest of long pebbles of suitable cutting power. A triangular piece of pennant-grit, 5 ins. long, and scored at intervals along its edge, was evidently used for smoothing shafts of some kind.

More than a dozen discs, rudely chipped out of pennant flag-stones and ranging from $1\frac{3}{4}$ to 5 ins. in diameter, were also met with, as also others made from potsherds, and the bottoms of vessels trimmed apparently to serve the same purpose. Such discs have been found on other Roman sites—Caerwent, Caer Wrgan (Llantwit Major), and Ely Race-course (Cardiff)—and have been regarded as covers of vessels or as objects used in some game.

A spindle-whorl, neatly shaped out of pennant-grit, $1\frac{1}{2}$ in. in diameter, and slightly ornamented with radiating scratches, was found, as also was another of similar size, made out of a piece of grey pottery.

A burnisher of veined agate is a trifle over an inch in length, and has the section of a joiner's pencil. It is polished, except



FIG. 21. STONE CARVED WITH PALM-BRANCH? ($\frac{1}{8}$).

at the square end which probably was inserted into a handle, the other end being roundly pointed, and showing signs of usage.

The carved stone, Fig. 21, was taken out of a modern wall in the Rectory Lane, but there is no doubt as to its Roman age. The incised device appears to be a palm branch, and it closely resembles those on a stone at Camelon, and figured in *Proc. Soc. Antiquaries, Scotland*, Vol. XXXV., p. 413.

Coins.—In excavations of the magnitude of a fort, where constant supervision on every spot is impossible, there is always a risk of coins being withheld by the finders, in consequence of exaggerated notions as to their value. Small, however, as was the number—seven only—of Roman coins handed over by the

labourers at Gellygaer, nothing has transpired to give rise to a suspicion that any were so withheld. It may be reasonably accepted, therefore, that under any circumstance the number found was small, and that the seven secured are fairly representative of the Gellygaer series.

In drawing up the following list I am much indebted to Mr. H. A. Grueber, F.S.A., of the British Museum, who has examined all the coins:—

- 1.—Republican Denarius; much worn. *Obv.*, helmeted head of Roma to the right. *Rev.*, a quadriga to the right with a flying Victoria above. The figure in the chariot is too much worn for identification, and the legends are quite effaced.
Mr. Grueber assigns *circa* B.C. 120 as the date of this coin.
- 2.—Republican Denarius; considerably worn, but less so than the preceding. *Obv.*, helmeted head of Roma to the right; L POMPONI CN F. *Rev.*, a warrior in a biga, to the right; legend effaced, but supplied by Mr. Grueber as L LIC CN DOM, who also gives the date as about B.C. 92.
- 3.—Vespasian (A.D. 69-79). Denarius of base metal, which has suffered much from the action of the soil. *Obv.*, Emperor's head to the left; CAESAR VESPASIANVS AVG. *Rev.*, Health seated to the left; [SALVS] AVG.
- 4.—Do. Denarius of baser metal than the preceding, and more corroded by the action of the soil. *Obv.*, Emperor's head to the right. *Rev.*, seated figure. Legends effaced.
- 5.—Domitian (A.D. 81-96). Denarius of base metal, considerably corroded. *Obv.*, Emperor's head to the right; - - DOMIT - - - GERM PM TR -. Type and legend of *Rev.* effaced.
- 6.—Domitian. First-bronze. *Obv.*, Emperor's head to the right; [IMP CAES DOMIT AVG G]ERM COS XII CENS PER PP. *Rev.*, Jupiter seated to the left, with fulmen and hasta; [IOVI CONSERVA]TORI.

- 7.—Nerva (A.D. 96-8). First-bronze; surface much corroded.
Obv., Emperor's head to the right; legend effaced.
Rev., two hands joined and holding a legionary eagle;
 [CONC]ORDIA [EXERCITV-VM].

The condition of the Republican denarii is in striking contrast with the Imperial, owing, without doubt, to the greater purity of their silver.* In fact, two of the Imperial denarii (4 and 5) are so extremely base, that their amount of silver must be very small indeed. The two first-bronze coins have lost all their metallic properties, being reduced to oxide throughout, and when found were in a very friable condition. The Domitian coin, however, retained its surface intact, and it evidently had seen but little wear, but much of its sharpness was unavoidably removed in cleaning. The surface of the Nerva coin, on the other hand, was honeycombed by the action of the soil, but such portions of its device and legends as remain, show that it also received but little wear.

Graffiti.—Only three examples of scratched inscriptions—doubtless the names or initials of the owners—have been observed on the Gellygaer pottery. The smallness of the number is not surprising, as many such markings may have been removed by the superficial decay of the potsherds. The three are here figured one-half the size of the originals. The first occurs on a piece of mortarium, and is obviously CONTII (of Contius). The second is on a fragment of the bottom of a red-ware jar. It is incomplete, but may be the termination of "Antonii." The third, also on a mortarium, appears to be the owner's initials, M.T.

On a large tile 1,572 by 1,074 ins., is some careless lettering,

* Upon this Mr. Haverfield writes as follows: "Roman coins minted previous to the foundation of the Roman Empire (B.C. 27) are not uncommon among remains of imperial date. They occur, for instance, in numerous hoards of which the latest coins belong to the third century. Various reasons seem to have contributed to the survival of these coins in use. Some, like Antony's legionary *denarii*, probably remained in use because they were rather heavily alloyed, in accordance with Gresham's Law. Others, and among these we may class the Gellygaer specimens, may have reached Britain by way of trade at an early date and remained in circulation there. They are the *serrati bigatique* which a writer contemporary with the occupation of Gellygaer mentions as preferred by the natives in Germany even in his own day."

scored on the surface while the clay was yet soft, apparently with a piece of twig. It is partly obliterated, but it evidently begins with C and ends with VIII, and there are one or two intervening letters. The second letter resembles the Greek *lambda*, and upon the strength of this, the Rector reads the inscription as CLAVIII, and makes it to refer to the 8th Cohort of the Augustan Legion, the legion located at Caerleon. Mr. Haverfield regards it as simply a brickmaker's scrawl, indicating, perhaps, the number of bricks made; and



FIG. 22. OWNERS' MARKS ON POTTERY. ($\frac{1}{2}$).

he is inclined to read it, C R VIII. It seems to me that there is a letter between the R and the V. This brick has several footprints of a large dog, and it may be mentioned that such footprints were not uncommon on the Gellygaer bricks and tiles.*

As already intimated more than once, many objects of more recent than Roman age were turned up by the spade during the excavation. As a rule, it was easy to see at a glance that they were medieval or modern. But sometimes they were so intimately mixed with the Roman—doubtless through the action of burrowing animals and worms—as to mislead, or, at least,

* In a Welsh diary of 1822, by John Jenkins, Baptist minister of Hengoed, and now in the possession of the Rector of Gellygaer, is described an inscription which appears to relate to a centurial stone. The following is a translation :—“The above letters are on a stone which was found in an old wall in the Gaer, near the village of Gellygaer.” The inscription, as given, is >. DEMIO. The initial angular mark (frequently shown as a reversed C) stands for *centurio* or *centuria*; but, as Mr. Haverfield remarks, the centurion's name is either imperfect or misread

to puzzle, the finders. For instance, a small intaglio of cast glass was brought up from the Roman level. The first impulse was to cherish it as valuable, but its bust was soon observed to bear a suspicious resemblance to that of Queen Anne; in fact, I am assured that it is the sort of thing that frequently adorns the cheap gilt rings and jewelry sold at fairs and by street hawkers. More amusing were the conjectures that some of these modern introductions at the North-East Gate gave rise to. It has been mentioned that part of the remains of this gate were removed some forty-three years ago for the sake of the stone. The hollow thus left became a convenient dumping-place for rubbish, for during the excavation sundry pieces of common glazed pottery, rusty iron, cinders, mortar, cottage wall-plaster, some retaining its colour-wash, etc., were found there. The lime-plaster with its colouring suggested an important chamber over the gate, the residence of an officer, say; the glazed pottery further differentiated between its refinement and the austerity of the barracks; a piece of iron that suspiciously recalled a modern gridiron, was pronounced to be the look-out of the gate; in more iron was seen the remains of plate-armour; but the attempt to diagnose another piece broke the proverbial camel's back—it was the scarcely-rusted handle of a nineteenth-century bucket!

A large and representative selection of the 'finds' are now in the Welsh Museum of Natural History, Arts, and Antiquities, at Cardiff.

SECTION VIII.

The Period of the Fort.

WHEN, and by whom, the fort was raised, and when and why it was abandoned, are questions which do not admit of direct answers, seeing that history is silent as to Roman Gellygaer; still, it is possible, I think, to reduce these events to comparatively narrow limits of time. Gellygaer was about the centre of the territory of the Silures, that "naturally fierce people" whose resistance was only crushed after long years of warfare; and it is largely from the historical references to that people that we must draw our conclusions.

In A.D. 48, the whole of south Britain as far as the Severn was in the firm grip of Rome, and the then new governor, Ostorius Scapula, was paving the way for the conquest of the Silures, by quelling successively the less formidable Cangi, Brigantes, and Icenii. Two years later occurred that defeat of the Silures and capture of their leader, Caractacus, which is familiar to every school-boy. The next step was the reduction of this warlike people; but in this the governor was not successful, for Tacitus tells us that the "camp-prefect and legionary cohorts left behind to establish fortified positions among the Silures" were well nigh annihilated. The following year Ostorius himself died, worn out by the incessant struggle.

For the following quarter of a century the policy of the successive governors seems to have been to simply hold the Silures in check by confining them to their own territory. At length their subjugation was resolutely taken in hand and accomplished by Julius Frontinus (A.D. 75-7). This would be immediately followed by the construction of roads and forts; but as Frontinus was recalled in A.D. 77 or 78, it is more than probable that their completion fell under the administration of his successor, the famous Julius Agricola, whose first operation was the subjugation of the Ordovices of mid-Wales.

This sequence of events suggests three alternatives for the date of the Gellygaer fort:—(1) the campaign of Ostorius, A.D. 50-1; (2) that of Frontinus, A.D. 75-7; or (3) some later date.

With regard to the *first*, there is no proof that the camp-prefect and his cohorts actually erected any forts, nor is it likely they did so, considering how short and ineffective their occupation was. We know from the evidence of the coins, etc., that our fort was in use *after* the second conquest of Siluria, so if it was first erected under Ostorius, the remains should have shown indications of the quarter of a century interval between the two conquests; but they certainly did not.

With regard to the *third*—upon the gradual settlement of Siluria—the need of fortified positions in the interior would become less, as was the case with the country generally. Apart from this, there are reasons, which will be considered shortly, for thinking that Gellygaer was neither of late type nor of late occupation.

This leaves us with the *second* as the most feasible alternative, namely, that our fort was one of a series erected to hold the newly-conquered region under, or soon after, Frontinus. This is a view which has much to commend it, and, so far as I know, nothing to militate against it. The remains themselves tend to confirm this conclusion, also to show that the fort was of short, and, at the same time, continuous occupation.

The general plan is of early type for Britain, and contrasts with those of the bastioned series—Richborough, Lymne, Porchester, Burgh Castle, Cardiff, &c.—the building or re-building of which forts is attributed to a later period. Mr. J. P. Gibson, on the other hand, thinks that the Gellygaer masonry is late, from its analogy to the late work in the forts of the Wall, which is of smaller stones and less careful construction than the earlier. When we compare, however, the work of widely separated districts we must take into account the local conditions. No matter how skilful the Gellygaer builders may have been, they, perforce, had to use such material as was available—thin pennant stones; and it is difficult to see how their construction could have been improved.

The coins, few as were found, point to an early date and a short duration. The latest possible date of these, it will be observed upon referring to the list upon page 91, is A.D. 98; and it is noteworthy that later coins, though much corroded, show little trace of wear. Leaving the Republican coins out of the question for the moment, it is significant that all the Imperial coins should be confined to a space of only twenty-nine years at most, A.D. 69-98. Now had the fort continued in use for, say, a century later than the last date, the chances are that coins of several subsequent emperors, notably, Trajan, Hadrian, and Antoninus Pius, would have been found in great numbers, while if the occupation continued to the general withdrawal from Britain, those of the "Thirty Tyrants" and of the Constantines should have turned up in vastly greater abundance. The inference, therefore, is that Gellygaer was abandoned shortly after A.D. 98. The large proportion of Republican coins, two out of seven, is a further hint in the same direction; that coins of that period should continue in circulation under the *earlier* emperors, was to be expected.

Then there is the fragment of cylindrical Samian bowl. It is true that this cannot throw light upon the duration of the occupation of the fort, but if the early disappearance of these vessels in Britain, as given on page 80, be accepted, the early origin of the fort must also be accepted.

The structural remains decidedly favour a short occupancy. Nothing was found during the excavations to suggest that any portion of the fort had been rebuilt. There were signs, it is true, of alterations, but proof there was none, that these had been necessitated by the effects of age or decay. On the contrary, the masonry everywhere was singularly fresh-looking, even that of the projecting pilasters of the gates, exposed as it was to wear and mishap, still retained its dressing in almost original sharpness.

Some features revealed by the excavations, as the heaps of broken brick for concrete (pages 27, 40, 57), the general absence of definite floors (pages 29, 55, 66), and the circumstance that only several of the gates and towers gave evidence of having been

tiled, suggest the question whether the fort was ever finished at all! But against this must be urged certain signs of use, as the worn condition of the roads and of the sills of the gates, and the wear—slight, it is true—on the steps of Building VIII., and those leading up to the rampart at the South-West Gate. The condition of the gate-sills might, indeed, be advanced to favour a long occupancy, but the rapidity with which they would wear down would, of course, depend upon the traffic. The observed amount of wear might easily have been reached in a few years, and it is probable enough that part of it might have been effected after the fort fell into disuse, by the carting away of building material. The absence of sculptured stones and inscriptions, and the comparative paucity of the pottery and the metallic objects further tend to the same conclusion—the shortness of the occupation.

Then, as to the termination of that occupation, there was nothing found to warrant a belief that the fort was taken by violence and its garrison overwhelmed. No human remains were brought to light. There certainly were indications of a conflagration in the eastern half, but such a disaster does not necessarily imply the stress of war.

Singly, these lines of reasoning may be open to question, but in the aggregate they furnish an argument of some weight to the effect that the Roman fort of Gellygaer was one of a series erected after the successful campaign of Frontinus against the Silures, with a view to their complete subjugation and the military administration of the conquered territory; and that after a short occupation—a quarter-of-a-century, maybe—it was abandoned, all serious opposition to Roman rule having apparently ceased.



Appendix.

I.—THE FORTS AND THE HYGINIAN CAMP COMPARED.

Mr. F. Haverfield, F.S.A., in the following communication to the author, succinctly expresses the present state of knowledge in this respect:—

“It is natural and customary, in estimating the results of the excavations of Roman forts like Gellygaer, to compare the facts revealed by the spade with the description of the Roman camp given by Hyginus, or whoever wrote the pamphlet *de munitionibus castrorum*. And it is convenient to adopt from Hyginus the terms which he employs to denote various portions of the camp—*prætorium*, *porta prætoria*, *prætentura*, *strigæ*, and the rest. But the process is accompanied by dangers; for here, as so often, our literary and archæological evidences relate to different things. Hyginus describes the large temporary encampments of armies on the march, capable of holding some 30,000 men, and covering eighty or a hundred acres. Archæological research has thrown no light on such encampments. The ‘camps’ which we know by excavation are distinct from these: they form two other classes of ‘camps,’ each with its own characteristics and object—(a) the large permanent fortress, garrisoned by a legion (5,000 infantry), and covering forty-five to fifty-five acres, and (b) the small permanent fort, like Gellygaer, usually garrisoned by auxiliaries, and varying in size from (roughly) three to eight acres. All three classes—the Hyginian encampment, the legionary fortress, the small fort—belong to the same period of time. The pamphlet of Hyginus, uncertain as its date is, lies within the limits of the second and early third centuries, and was not improbably written near the beginning of the second century. The forts and fortresses known to

us by excavation may be dated to one or other part of the same epoch, and they appear to have been constructed on the same models throughout it. But though contemporary, the three kinds of 'camps' agree very slightly. Some general features are common to them—rectangular outline, rounded corners, number and position of gates—and once or twice we can trace a common terminology. One inscription mentions the *porta pratoria* of a small fort in Roumania, and another the *pratentura* (as it seems) of a small fort on Hadrian's Wall. But the purposes of the three kinds of 'camps' are so different that one would not expect great similarities, and, as a fact, their internal details differ widely. The chief internal feature of the Hyginian encampment is the general's tent or lodging, *pratorium* by name, planted in the centre of the camp. But the corresponding spot in the permanent forts and fortresses is not occupied by the commandant's lodging or residence; that is traceable elsewhere, and the centre is occupied by an edifice of obvious importance and elaborateness, which certainly was not a residence. Possibly it reproduces in some way the altars, *auguratorium*, and tribunal, which formed (as it were) an official annexe to the Hyginian *pratorium*, but in that case the annexe has usurped the site of the proper *pratorium*. What it was called we do not know for certain. By modern writers it is usually styled 'prætorium.' But no direct evidence exists to prove that the term *pratorium* was applied to any edifice in the small forts, and if we assume that it was used, we have still to go on to decide what edifice was the *pratorium*. If the central building, the obstacle arises that everywhere else in Latin, *pratorium* means the residence of the general or of someone in something like a general's position. If the commandant's lodging, the obstacle arises that the *pratorium* is not in its Hyginian position. Others, quoting Hyginus, have called the central building the *Forum*, but in reality, the actual text of Hyginus does not contain the word *forum*. We have, perhaps, too little evidence as yet to decide this point; the one thing plain is that in respect of the central element of the camp, Hyginus and the small forts are widely at variance. They agree no better in respect to the buildings round the centre, the *latera pratorii* and *quæstorium* of Hyginus, and even where we find the

same name used in both Hyginus and the small ports—for example, *porta pratoria*—we cannot be sure that the name means the same in each case, for (as Mommsen has observed) it is not easy to determine which is the prætorian and which the decuman gate in a small permanent fort.”

II.—ARCHÆOLOGICAL RESEARCH.

The need for more thoroughness and system is well put by Mr. John Garstang in a paper *On Some Features of Roman Military Defensive Works*, in the *Transactions of the Historic Society of Lancashire and Cheshire*, Vol. LII.

“Great though the progress of investigation has been in recent years, much yet remains to be done, or to be re-done in more systematic fashion, before that can be effected. Each branch of archæological evidence requires separate and special study. The pottery, to the neglect of which Mr. Haverfield has called attention in *The Athenæum*, is still to be classified and reduced to types suitable for reference. The grouping of coins, again, the nature of fortifications and defences, the types of masonry, construction, architecture and kindred details, are still to give their evidence. There may then evolve a relative sequence, which the more direct testimony of a dated inscription or literary reference may make absolute. The providing of material in this way, to be available for study, is still to be regarded as the duty of the investigator. Excavation is a science, and its methods must be systematised. Those principles of research which Professor Petrie has pioneered in Egypt, cannot be too soon adopted in our own country. The uncovering of ruins or the disentangling of confused foundations is a small part merely of the excavator’s labours.

“These points suggest some of the limitations that face the student of Roman Britain, yet other difficulties also beset him. Each report of excavations appears in new guise, and treats new theories in new ways. Plans of buildings and the like, numerous

and often intelligible though they be, appear to every conceivable scale, and in every possible combination of light and shade or hatching. Sometimes this is caused by a mere eccentricity of the publishers; more often by want of understanding as to the best system to adopt. The consistent character of the plans yearly published by the excavators of Silchester is a conspicuous exception. Cannot the same august society which patronizes that undertaking set an enduring example by endowing also a 'Corpus of plans of Roman works in Britain,' to a scale and style fixed after due consideration, that shall be suitable for imitation by local societies and private individuals also."

III.—TYPES OF ROMAN FORTS.

The following extract from the *Roman Coast Fortresses of Kent*, by Mr. George E. Fox, F.S.A., in the *Archæological Journal* for 1896, is of peculiar interest to local readers, for the Gellygaer fort and Cardiff Castle are remarkably fine examples of the two types, neither of which had been investigated at the time he read the paper:—

"There are two very definite types into which Roman military stations may be divided. The first shows a rectangular area, sometimes approaching a square, surrounded by a wall unbroken by any internal projection; except in rare instances the towers at the gateways had no external projection. At the same time, square towers occur internal to the wall, between the gateways, and sometimes in the internal angles, which are always rounded. Sometimes these towers at the angles are reinforced by a widening of the wall, somewhat resembling a platform, for the whole length of the curved line. Occasionally the wall serves as a retaining wall to a bank of earth raised against it on the inside, which bank afforded ample room for placing military engines, and allowed space for the concentration of the defenders at any given point. Generally speaking, the walls of camps of this first type are not

so thick as those of the second, some not being more than 5 feet in width. The gates of these stations consist either of a single arch, or double arches, according to their importance, the width of each arch being from 10 to 12 feet. They are always flanked by towers. Between the towers and over the archways, a gallery with windows, back and front, was carried; occasionally, if the gate was a deep one, a chamber took the place of the gallery between the towers.

"As a rule, a ditch (sometimes two, or even more ditches) ran at the foot of the walls with an intervening berm, and completed the defences.

"It would occupy too much time to enter into the internal arrangements of camps of the first type, though they offer a most interesting subject for study. These notes, however, must be confined to a description of the defences only.

"In Britain, examples of the first type are to be found in the stations on the Wall of Hadrian, and in the great Legionary camp, at York, and also to these, amongst others, may possibly be added the largest of the camps in Eastern England, the *Venta Icenorum* (Caister, near Norwich).

"The type of fortified station here described was certainly in existence in the reign of Hadrian (A.D. 117-138). How much later it prevailed it is not easy to say; but towards the end of the third century it seems to have given place to another, the second type mentioned. In this latter, the unbroken line of enclosing wall was no longer to be seen; instead, the towers, which before had been as a rule internal, now boldly projected from the line of enclosure, and the principle by which every part of a fortification should command and defend the other had been definitely adopted and acted upon.

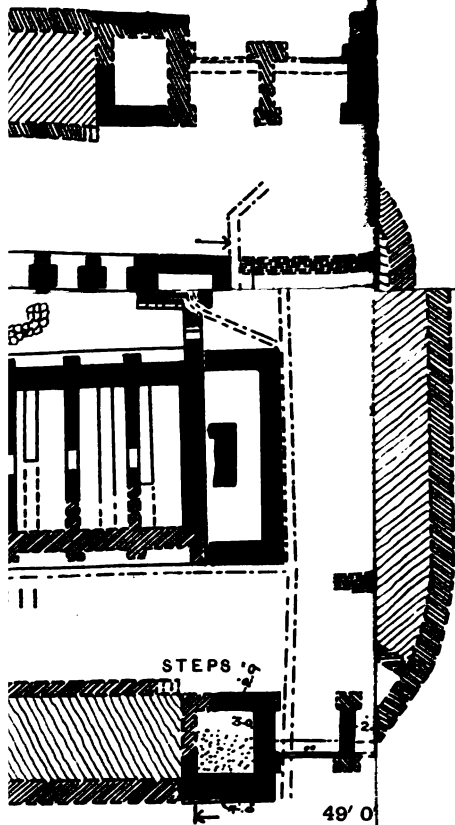
"A fine and remarkable example of the second type is to be seen in the walls of Rome itself, begun by the Emperor Aurelian, and finished by Probus A.D. 280, much of which wall still exists. The wall is 12 feet thick in its lower portion, and constructed of solid concrete faced with brick. The square towers occurring at frequent intervals with which it is studded projected as much as 13 feet from its face. The lower part of the towers, like the wall, is solid. The gates of the second type did not essentially differ from those of the first, but the square towers on either side of the arches of entrance were now

more often exchanged for semi-circular ones with slightly prolonged sides. In fact, as the years went on, it was found that the last-named form of tower was stronger and offered greater advantages for defence than the earlier square tower, against whose angles the battering ram could be used with effect. The semi-circular tower then came commonly into use, though the square tower was never abandoned. Other forms for towers were invented. In the great palace fortress of Diocletian at Spalato, the gateway towers are octagonal, while those at the angles and the intermediate ones are square.

"In this country the towers of the modified semi-circular plan mentioned are almost invariably solid, containing no chambers; they do not rise above the rampart walk, nor are they of any great size. They may be found added to pre-existing walls, or may form part and parcel of the walls of which they are the main defence. In the latter case the walls are generally of considerable thickness, and the structure may fairly be considered one of comparatively late date."

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IV.—GELLYGAER EXCAVATIONS FUND.

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James Bell	2	2	0	—	—	—	—	—	—
British Association for the Advancement of Science	—	—	—	—	—	—	5	0	0
The Most Noble the late Marquess of Bute	31	10	0	—	—	—	—	—	—
The Most Noble the Marquess of Bute	—	—	—	—	—	—	13	0	0
Cambrian Archaeological Association ..	—	—	—	—	—	—	10	0	0
Cardiff Corporation Museum Committee	25	0	0	—	—	—	25	0	0
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J. S. Corbett	5	0	0	—	—	—	—	—	—
John Cory, J.P., D.L.	5	5	0	—	—	—	—	—	—
Richard Cory, J.P.	5	5	0	—	—	—	—	—	—
D. Duncan & Sons	3	3	0	—	—	—	—	—	—
W. T. Edwards, M.D., J.P.	—	—	—	1	1	0	—	—	—
Franklen G. Evans, F.R. Met. Soc., J.P.	2	2	0	—	—	—	1	1	0
Sir John Evans, K.C.B., etc.	—	—	—	2	2	0	—	—	—
T. Mansel Franklen	1	1	0	—	—	—	—	—	—
Walter Franklin	2	2	0	—	—	—	—	—	—
William Griffiths	—	—	—	1	1	0	—	—	—
George Hallett	—	—	—	1	0	0	1	0	0
G. E. Halliday, F.R.I.B.A.	—	—	—	—	—	—	1	1	0
F. J. Haverfield, F.S.A.	—	—	—	5	0	0	—	—	—
H. Heywood, F.R. Met. Soc., J.P.	—	—	—	2	2	0	—	—	—
Col. Sir E. S. Hill, K.C.B.	—	—	—	5	0	0	—	—	—
S. S. Howard	—	—	—	1	1	0	—	—	—
A. E. Hudd, F.S.A.	1	1	0	—	—	—	—	—	—
C. H. James, J.P.	5	5	0	5	5	0	*20	15	3
C. R. James	—	—	—	1	1	0	—	—	—
F. T. James	—	—	—	2	2	0	—	—	—
W. P. James	1	1	0	—	—	—	—	—	—

* To pay for Illustrations in the Memoir.

	1900.			1901.			1902.		
	£	s.	d.	£	s.	d.	£	s.	d.
E. Jenks	0	10	6	—			—		
John Jenkins	1	1	0	—			0	10	6
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Total	£137	0	6	82	17	0	90	0	3

GELLYGAER EXCAVATIONS FUND.

Summarized Account of Receipts and Payments from 8th November, 1899, to 2nd December, 1902.

RECEIPTS.			PAYMENTS.		
To Contributions as per list, viz. :—					
During the year 1900			By Wages	£	s. d.
" " 1901			" Cost of Filling-in—Contract and Extras ..	280	0 8
" " 1902			" Rent	80	0 0
			" Other Expenses	20	0 0
,, Balance—Deficit				22	12 11
				£402	13 7

N.B.—Actual Deficit, 2nd December, 1902, as per
above account 92 15 10

Estimated further cost, mainly in connection
with the publication of the Memoir 40 0 0

Total Estimated Deficit, for which the Cardiff
Naturalists' Society is responsible .. £132 15 10

WENTWORTH H. PRICE, F.C.A.,
Hon. Treasurer of the
Cardiff Naturalists' Society.
Cardiff, 2nd December, 1902.

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VOL. XXXVI.

1903

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REPORT

AND TRANSACTIONS

Vol. XXXVI.

1903

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EDITORIAL NOTE

Besides the contributions and ordinary routine matter, this Volume of the Transactions contains a Catalogue of the Society's Library; the Index to the Transactions, Vol. XVIII. to XXXVI.; and a List of the Members of the Society.

The "Standard octavo size," recommended in the British Association Report, 1895, for publications of Scientific Bodies, has been adopted as the size of the Transactions.

WILLIAM SHEEN.

December, 1903.

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METEOROLOGICAL OBSERVATIONS IN THE SOCIETY'S DISTRICT, 1902.

BY H. HEYWOOD, F.R. MET. SOC.

IN presenting to the readers of this section of the Society's Transactions, the Rainfall records for the year 1902, the Averages (in most instances for the previous fourteen years) have been continued.

The average monthly rainfall over the whole of the Society's district (comprised within a semi-circular area having the Beacons as its most northernmost point, its base the coast line from Neath to Chepstow, and with a mean height of 526 feet above the sea level) is as follows:—

January	...	...	...	3'28 inches.
February	...	...	...	2'29 "
March ...	...	..	...	3'26 "
April ...	...	...	...	2'87 "
May ...	...	...	...	2'63 "
June ...	...	...	...	3'41 "
July ...	...	...	...	2'13 "
August	...	...	...	4'04 "
September	...	...	...	2'76 "
October	...	...	...	4'76 "
November	...	...	...	5'20 "
December	...	...	...	5'09 "

41'72

OBSERVERS.						FEET ABOVE SEA LEVEL.	INCHES OF RAIN.
C. H. PRIESTLEY, Summit of Tyle Brith, Brecknockshire...						2350	57'90
„ Nant Penig, Brecknockshire	...	...	...	...	...	2000	61'09
„ Taff Fawr	...	...	...	...	...	1340	59'84
WM. JONES, Portluest Wen Reservoir, Glam.	...	...	...	...	...	1255	49'49
P. WILLIAMS, Blaenavon, Mon.	...	...	...	...	...	1135	51'29
C. H. PRIESTLEY, Cantreff Reservoir, Brecknockshire	...	...	...	...	...	1120	53'92
†R. C. HARRISON, Gwernllwyn, Dowlais	...	...	...	...	...	1084	42'84
G. A. BROWN, Tredegar...	...	...	...	...	...	1024	50'58
FORSTER BROWN & REES, Glyncoirwg	...	...	...	...	...	717	66'05
W. T. LEWIS (Sir, Bart.), Bute Merthyr Colliery, Treherbert	...	...	...	...	...	670	62'58
GOMER S. MORGAN, Pontyclun, Glam.	...	...	...	...	...	582	51'68
*HUGH L. P. LOWE, Shirenewton Hall, Chepstow	...	...	...	...	...	—	—
W. T. LEWIS (Sir, Bart.), The Mardy, Aberdare	...	...	...	...	...	431	44'40
EVAN JONES, Abernant, Aberdare	...	...	...	...	...	430	40'97
W. E. C. CURRE, Itton Court, Chepstow	...	...	...	...	...	390	31'77
†F. J. MITCHELL, Llanfrechfa Grange, Mon.	...	...	...	...	...	326	36'22
†E. TUDOR OWEN, Ash Hall, Cowbridge	...	...	...	...	...	315	36'70
†MORGAN LINDSAY (Lieut.-Col.), Ystrad Mynach	...	...	...	...	...	315	44'35
HENRY CLAY, Piercefield Park, Chepstow	...	...	...	...	...	310	28'60
W. JONES, Reservoir, Pontypridd	...	...	...	...	...	300	36'69
GODFREY L. CLARK, Talygarn, Glam...	...	...	...	...	...	250	48'24
†J. WILLIAMS, Wern Boys' School, Ystalyfera	...	...	...	...	...	240	50'06
H. M. JACKSON (Sir, Bart.), Llantilio Court, Mon.	...	...	...	...	...	207	29'75
EDWIN C. POLE, Neath	...	...	...	...	...	204	40'54
JAMES BELL, C.E., Park Road, Barry...	...	...	...	...	...	191	30'86
†H. HEYWOOD, Witla Court, Rumney, Cardiff	...	...	...	...	...	177	33'91
LORD LLANGATTOCK, The Hendre, Monmouth	...	...	...	...	...	176	23'63
C. H. PRIESTLEY, Llanishen Reservoir, Glam.	...	...	...	...	...	155	35'33
„ Lisvane	...	...	...	...	...	150	33'85
„ "Heath" Filters, Glam....	...	...	...	...	...	132	35'13
†O. H. JONES, Fonmon Castle, Glam.	...	...	...	...	...	130	32'72
C. H. PRIESTLEY, Cogan	...	...	...	...	...	121	31'21
FRANKLEN G. EVANS, F.R.A.S., Llwynarthan	...	...	...	...	...	72	32'52
C. H. PRIESTLEY, Ely	...	...	...	...	...	53	35'15
A. PETTIGREW, Castle Gardens, Cardiff	...	...	...	...	...	38	35'23
†TORGORMAH REES, C.E., Porton, Goldcliff, nr. Newport, Mon.	...	...	...	...	...	27	25'25
†JOHN D. ALEXANDER, M.D., Esplanade House, Porthcawl	...	...	...	...	...	—	29'01
†C. T. VACHELL, M.D.	...	...	...	...	...	—	—
†E. WALFORD, M.D.	...	...	...	...	...	—	—

* Lapsed.

† Height not given.

‡ General Observations.

MAIN FEATURES OF THE MONTHS.

JANUARY.—Temperature mild and generally above the average during the first few days of the month and from the 20th to 24th. Four or five days of the middle of the month were seasonably wintry, the minimum Temperature occurring on the 15th. The closing days after the 24th wintry with keen winds, frosts, and occasional bright sunshine.

Maximum Temperature 52.4° on the 9th.

Minimum Temperature 22.2° on the 15th.

Mean daily range of Temperature 9.27° .

Frost registered in the screen on 9 days.

Hoar Frost on the 14th to 16th, 19th, 25th and 26th, 29th to 31st.

Fog on the 12th to 14th, 17th to 19th, 23rd and 24th.

Ice on the 15th ($\frac{3}{4}$ in. thick), also on the 25th, 26th, 29th, 30th, and 31st.

Snow on the 25th and 26th.

Rainbows on the 2nd at 10.30 and 11.50 a.m., also the 5th at 9.13 a.m. and 2 p.m.

Thunder with Lightning 8.30 to 9 a.m. on the 28th.

Hail on the 24th and 28th.

Humidity 88 per cent.

Total Rainfall on 17 days 2.01 inches.

FEBRUARY.—Cold, dull weather at the beginning of the month, afterwards bright and sunny almost daily until the 19th. Skating very general, with Ice $\frac{5}{8}$ in. thick locally, on the 18th. General thaw on the 19th with milder weather to the close of the month.

Maximum Temperature 53.1° on the 28th.

Minimum Temperature 20.5° on the 14th.

Mean daily range of Temperature 10.50° .

Frost registered in the screen on 21 days.

Hoar Frost on the 1st to 3rd, and 7th to 18th.

Fog on the 4th and 5th, and 19th to 26th.

Ice on the 1st to 3rd, 5th to 7th, 9th to 18th, varying from $\frac{1}{2}$ in. on the 1st to $5\frac{1}{2}$ in. thick on the 18th.

Snow on the 3rd, 8th, and 9th.

Rainbows 2.45 and 5 p.m. on the 27th, and at 12.57 p.m. on the 28th.

Humidity 91 per cent.

Total Rainfall on 13 days 1.44 inches.

MARCH.—An exceptional month of placid weather with temperature above the average, and much humidity. On the 6th a brilliant sun-pillar was observable just before sunset. (See the Society's Transactions, vol. 34, p. 85.)

Maximum Temperature 57.2° on the 28th.

Minimum Temperature 25.5° on the 6th.

Mean daily range of Temperature 12.81° .

Frost registered in the Screen on 3 days.

Hoar Frost on the 6th and 7th, 24th and 26th.

Fog on the 1st, 2nd, 5th to 7th, 11th, 29th, and at 10 p.m. on the 30th.

Dew on 6 days.

Ice on the 6th, 7th and 24th.

Hail at 11.10 a.m. the 20th.

Rainbow at 1.10 p.m. the 20th.

Humidity 84 per cent.

Total Rainfall on 18 days 2.82 inches.

APRIL.—The first fortnight was cold with bitter cutting North-east winds of considerable force about the 11th. Weather generally like the middle of March and vegetation at a standstill in consequence. The second half of the month was more seasonable.

Maximum Temperature 60.1° on the 25th.

Minimum Temperature 30.0° on the 14th.

Mean daily range of temperature 15.62° .

Frost registered in the Screen on 4 days.
Hoar Frost on the 2nd, 3rd, 6th, 7th, 11th, 13th and 14th.
Dew on the 8th, 9th, 17th, 18th and 25th.
Thin Ice on the 2nd, 3rd, 11th and 14th.
Hail at 8 p.m. on the 3rd.
Rainbow at 4.10 p.m. on the 20th, 3.45 p.m. the 22nd, 5.10 p.m. the 24th.
Thunder at 8 p.m. on the 20th, and at 1 p.m. on the 23rd, with lightning at 2.15 p.m.
Lunar Halo at 10.45 p.m. on the 19th.
Humidity 76 per cent.
Total Rainfall on 13 days 2.22 inches.

MAY.—A month of remarkably cold, ungenial weather, the temperature during the first three weeks never rising above 57°. Wind generally Westerly or N.W.

Maximum Temperature 70.7° on the 23rd.
Minimum Temperature 32.1° on the 7th.
Mean daily range of Temperature 15.46°.
Hoar Frost on the 7th.
Dew on the 11th to 13th, and 24th to 26th.
Thunder at 2.15 p.m. on the 18th.
Lightning at 10.0 p.m. on the 6th.
Humidity 71 per cent.
Total Rainfall on 23 days 2.11 inches.

JUNE.—Temperature exceptionally low from the 7th to the 24th, when almost sub-tropical heat set in with extreme suddenness, which continued until the end of the month. Wind chiefly Easterly.

Maximum Temperature 79.2° on the 28th.
Minimum Temperature 41.0° on the 7th.
Mean daily range of Temperature 14.40°.
Dew on the 4th, 11th, 17th, 18th, 24th, 25th and 30th.
Fog on the 17th and 25th.

Thunder at 12 noon on the 1st.

Lightning at 10.15 p.m. on the 30th.

Humidity 80 per cent.

Total Rainfall on 17 days 2.68 inches.

JULY.—Brilliant summer weather during the middle of the month but gales and heavy rain set in on the 19th and colder gloomy days followed to the end of the month more suggestive of November than the dog days.

Maximum Temperature 78.6° on the 14th.

Minimum Temperature 43.5° on the 12th.

Mean daily range of Temperature 16.16° .

Dew on the 6th, 7th, 8th, 12th to 18th, 23rd and 24th, 30th and 31st.

Rainbow 7.15 p.m. on the 26th.

Humidity 73 per cent.

Total Rainfall on 11 days 1.76 inches.

AUGUST.—Colder than usual with much rain. Brilliant meteor on the 19th at 9.45.

Maximum Temperature 73.8° on the 16th.

Minimum Temperature 43.0° on the 26th.

Mean daily range of Temperature 14.46° .

Dew on the 1st, 2nd, 5th, 9th to 11th, 15th and 16th, 19th to 22nd, 25th to 28th.

Thunder at 10.30 a.m. the 12th and 9.15 p.m. the 29th.

Rainbow 6.30 p.m. the 13th, 4.45 p.m. the 14th, and 4.40 p.m. the 24th.

Lunar Corona with brilliant clear prismatic colors at 10.45 p.m. on the 19th.

Humidity 82 per cent.

Total Rainfall on 24 days 4.96 inches.

SEPTEMBER.—Opened dull, with strong S.E. to S.W. gale on the night of the 2nd—3rd. Generally unsettled and unseasonable.

Maximum Temperature 70.1° on the 8th.

Minimum Temperature 38.7° on the 18.

Mean daily range of Temperature 15.09° .

Dew on the 1st, 2nd, 5th to 9th, 17th to 20th, 24th to 30th.

Fog on the 25th, 26th, 27th and 28th.

Rainbow 5.15 p.m. the 3rd, 5.35 p.m. the 4th, 6.15 p.m. the 16th, and 7.20 a.m. the 17th.

Thunder and Lightning at 7.10 p.m. the 3rd, Thunder at 8.15 a.m. the 4th.

Humidity 83 per cent.

Total Rainfall on 14 days 1.84 inches.

OCTOBER.—A month of many wet days, but the total fall was below the average generally.

Maximum Temperature 61.9° on the 10th.

Minimum Temperature 38.0° on the 19th.

Mean daily range of Temperature 11.00° .

Dew on the 3rd, 7th, 8th, 12th, 19th, 21st, 23rd, 24th, 25th, 27th and 31st.

Fog on the 19th, 23rd, 25th and 28th.

Rainbow at 12.30 p.m. and 4.10 p.m. the 16th, 7.10 a.m. the 18th, 7.50 a.m. the 21st, 9.20 a.m. the 22nd.

Humidity 86 per cent.

Total Rainfall on 21 days 3.58 inches.

NOVEMBER.—Unseasonably mild as regards Temperature during the first half of the month with several hours of sunshine daily, but sharp frost setting in on the 18th destroyed all plants in bloom.

Maximum Temperature 59.0° on the 1st.

Minimum Temperature 29.8° on the 21st.

Mean daily range of Temperature 8.18° .

Frost registered in the Screen on 4 days.

Hoar Frost on the 18th to 23rd.

Dew on the 1st, 2nd, 3rd, 13th to 15th and 27th.

Fog on the 3rd, 4th, 5th, 6th, 9th, 11th, 12th, 15th, 23rd and 27th.

Ice on the 18th $\frac{1}{8}$ in., 19th $\frac{1}{8}$ in., 20th $\frac{1}{4}$ in., 21st $\frac{3}{8}$ in., and 22nd.

Light Snow on the 19th and 20th.

Rainbows 8.20 a.m., 2.25 and 3.20 p.m. on the 7th, 11.55 a.m. the 8th, and 1.5 p.m. on the 23rd.

Brilliant Meteor at 9.40 p.m. on the 28th.

Humidity 89 per cent.

Total Rainfall on 19 days 4.81 inches.

DECEMBER.—Seasonably cold at the beginning of the month, afterwards very mild and temperature above the average.

Maximum Temperature 54.1° on the 17th.

Minimum Temperature 21.8° on the 7th.

Mean daily range of Temperature 8.12°.

Frost registered in the Screen on 7 days.

Hoar Frost on the 3rd to 8th, 12th, 30th and 31st.

Dew on the 23rd and 24th.

Fog on the 1st, 12th, 23rd and 24th.

Ice on the 4th $\frac{3}{8}$ in., 5th $\frac{1}{2}$ in., 6th 1 in.; thick Ice on the 7th and 8th; Ice also on the 30th.

Snow on hills on the 29th and 30th.

Hail 12.50 noon on the 28th.

Rainbow 12.15 noon on the 15th.

Lightning 9.45 p.m. on the 30th.

Humidity 88 per cent.

Total Rainfall on 16 days 3.68 inches.

TEMPERATURE.—STEVENSON SCREEN RESULTS.

1902.		ABSOLUTE EXTREMES OF TEMPERATURE.					
		Mean Temperature.	Mean Daily Range of Temperature.	HIGHEST.		LOWEST.	
				Temp.	Date.	Temp.	Date.
		°	°	°		°	
January	...	41°74	9°27	52°4	9th	22°2	15th.
February	...	35°53	10°50	53°1	28th	20°5	14th.
March	...	45°11	12°81	57°2	28th	25°5	6th.
April ...	...	45°81	15°62	60°1	25th	30°0	14th.
May ...	...	49°14	15°46	70°7	23rd	32°1	7th.
June ...	...	56°76	14°40	79°2	28th	41°0	7th.
July ...	...	59°08	16°16	78°6	14th	43°5	12th.
August	...	58°82	14°46	73°8	16th	43°0	26th.
September	...	55°80	15°09	70°1	8th	38°7	18th.
October	...	50°84	11°00	61°9	10th	38°0	19th.
November	...	44°92	8°18	59°0	11th	29°8	21st.
December	...	41°19	8°12	54°1	17th	21°8	7th.
MEANS		48°73	12°59	Highest 79°2	June 28th	Lowest 20°5	Feb. 14th.
MEANS, 1901 ...		49°12	13°67	Highest 87°5	July 20th	Lowest 20°8	Nov. 17th.
MEANS, 1900 ...		49°91	13°07	Highest 86°3	July 19th	Lowest 20°8	Feb. 9th.
MEANS, 1899 ...		50°65	14°21	Highest 86°6	Aug. 24th	Lowest 14°9	Dec. 15th.
MEANS, 1898 ...		50°85	13°35	Highest 81°4	Sept. 6th	Lowest 26°4	Feb. 21st.

All observations are taken at 9 a.m. Local and not Greenwich time.

DIRECTION OF THE WIND.

1902.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
January ...	5	—	3	—	2	—	20	1
February ...	3	—	17	1	5	—	2	—
March ...	4	—	5	—	6	1	14	1
April ...	3	—	14	—	5	—	8	—
May ...	9	4	5	—	—	—	13	—
June... ..	—	1	15	1	2	1	9	1
July ...	4	1	3	—	1	—	22	—
August ...	1	2	11	1	4	—	10	2
September ...	2	5	13	—	1	3	6	—
October ...	2	—	12	—	2	—	15	—
November ...	2	2	16	—	3	—	7	—
December ...	5	—	10	—	4	—	11	1
TOTALS ...	40	15	124	3	35	5	137	6
TOTALS, 1901 ...	63	22	108	5	41	10	105	11

The direction of the wind is given according to true, and not to magnetic, bearings.

GENERAL OBSERVATIONS.

I DESIRE to express to all Observers the Society's great appreciation of their voluntary labours, and my own thanks for the returns and notes which have been sent to me.

I gladly welcome the new returns from Mr. Priestley at summit of Tyle Brith, Llanishen Reservoir and Heath Filters, and from Dr. Alexander at Porthcawl; and of the absent records regret the loss of that from Shirenewton after so many years continuity, and which Mr. Lowe is now no longer able to continue.

Regular returns have been supplied from my own station to the Royal Meteorological Society throughout the year, and the results appear in the "Meteorological Record."

Observations on Meteorological and on Agricultural Phenomena, *i.e.*, Crop production are by no means so effectually followed as they deserve, for it must be admitted that temperature of the air and of the soil at the surface and at different depths—humidity—intensity of sunlight—duration and velocity of wind, influence materially the growth of plants and the yield of grain and straw. The Potato crops may be said to have been a failure, and according to "The Times" report the general average yield of Hay in Glamorganshire was about 31 cwt. per acre, against 17 cwt. the previous year, and in Monmouthshire the yield was from 29 to 31 cwt. The general average yields in Great Britain of the following were:—Wheat, about 33 bushels per acre; Barley, 36 to 37 bushels, and Oats, 46 bushels, as compared with the previous ten years' averages of Wheat 29·9 bushels; Barley, 32·8 bushels, and Oats, 38·3 bushels. All were lacking in quality by reason of inclement weather and little sunshine.

From the Stevenson Screen results (on page 9), it will be noticed that the mean temperature has yearly decreased during the last five years.

Dust Fall or so-called Blood-rain. Various observers in the Society's District reported that the slight Rainfall on January 22nd, 1903, contained quantities of dust, which, at Barry, had a pale pink salmon color—at Merthyr Mawr a yellowish color—and at West Usk Lighthouse a pinkish color. Some differences of opinion have been expressed as to whether this dust-fall was due to an explosion of Gelignite which occurred at Perran Porth near Truro, on January 16th, or to dust-fog blown over from the Sahara, but the latter appears certainly the most probable.

Mr. R. C. Harrison reports that the Rainfall at Dowlais of 42·84 inches is 5·876 inches below the average of 16 years (1887-1902 inclusive), although the number of rainy days, *i.e.*, 196, is excessive, the average being only 188 days. There were 17 days of ·50 and under 1·00 inch of Rain, 3 days of 1 inch and under 1½ inch, and 1 day of 1·50 inch and under 2 inches.

Highest shade Temperature 83° on July 13th.

Lowest shade Temperature 10° on February 8th.

Greatest daily range of Temperature 37° on July 13th.

Mr. O. H. Jones reports that at Fonmon Castle the year's Rainfall was 4 inches below average of past 18 years, but with an unusually large number of rainy days compared with the total Rainfall, and a very even distribution of Rain over the whole year. Wet Summer; June having the heaviest Rainfall recorded by him for that month. Sunshine lacking throughout the year, and generally very damp. Only one fall of over 1 inch of Rain in 24 hours, on September 23rd.

Lieutenant-Colonel Morgan Lindsay states that although slightly greater than in 1901, the Rainfall at Ystrad Mynach

in 1902 was 10 inches below average of previous 5 years, and, if we neglect 1901, 13 inches below the average of the preceding 4 years.

Mr. F. J. Mitchell's remarks on the weather at Llanfrechfa Grange intimate a deficient Rainfall in winter, a fair genial year, not so warm a summer as previous years. Potato crop very deficient, small bulbs and few of them.

Mr. E. Tudor Owen states that at Ash Hall, Cowbridge, the year's Rainfall was 5.59 inches below the average for 10 years (14 years average shows a loss of 5.26 inches) and is the lowest fall since 1890. 12 in. Snow on the 7th February was the only fall during the year.

Mr. Torgormah Rees remarks that at Porton the strongest wind occurred on December 29th, when a heavy gale from the Sou-West exerted a pressure of 19lbs. to the square foot, equal to a velocity of 62 miles an hour.

Dr. Charles Vachell reports from his observations taken at Park Place, Cardiff, that a temperature of 80° and upwards was recorded only on four days in 1902, *i.e.* June 24th 80°, 27th 83.2°, 28th 85°, and on July 14th 83.3°.

Mr. James Williams, of Ystalyfera, reports the three first and last months of 1901 and 1902 to be almost identical in Rainfall and wet days. The months April to September inclusive had over 6 inches less Rain and 12 more wet days than 1901 year, making spring and summer very cold and uncongenial. Fruit and harvest generally poor.

Dr. Walford states that the meteorological conditions to which Cardiff has been subject during the past three years have, on the whole, been favourable to the health of the community. Taking the death-rate as a test, each of the successive years—1900, 1901 and 1902 have been characterised by a low rate of mortality. Although the influence of the weather upon the

public health cannot easily be separated from that of other conditions of environment, yet the varying death-rates in the several quarters of the year sufficiently indicate the influence of the different seasons upon the mortality from certain diseases, and at the age periods most susceptible to the effects of temperature. Mild winters and cool summers both produce a low death-rate; the former by prolonging the life of the old and infirm, and the latter by reducing the mortality from infantile diarrhoea, a disease which prevails so extensively in hot and dry summers.

Diseases of the lungs and air passages, such as pneumonia and bronchitis, are especially fatal amongst old people in very cold winters. In this country the influence of cold is more marked than that of heat; the latter being of comparatively short duration, and by no means excessive; consequently we usually find the highest death-rates occurring in the first and fourth quarters of the year, and the lowest in the second and third quarters.

The weather during the year under consideration was generally mild in the winter and cool in the summer, and a low death-rate was, therefore, to be expected. The 2,822 deaths were equivalent to an annual rate of 16·7 per 1,000 persons living, corresponding almost exactly with the rates in the two preceding years.

The rates of mortality in the several quarters of the year 1902 were as follows:—First quarter 17·4, second quarter 15·0, third quarter 15·1, and fourth quarter 19·3 per 1,000. An extensive epidemic of Measles, which prevailed during the autumn and winter, caused a heavy mortality from pulmonary complications, when the cold weather set in, and raised the death-rate in the fourth quarter of the year. This disease alone caused 118 deaths out of a total of 816 from all causes during that quarter.

The third or summer quarter was characterised by a somewhat low mean temperature, and by a Rainfall rather above the average, these conditions producing as usual a low rate of mortality from infantile diarrhoea.

From the following table, *shewing the relation between the temperature of the air, rainfall and diarrhœal mortality during the third quarters of the ten years 1893-1902*, it will be seen that the lowest death-rates from this cause occurred in the third quarters of the years 1894 and 1902, and corresponded with lowest mean temperatures.

Third Quarters, Year.	Diarrhœal Death-Rate.	Mean Temperature.	Rainfall in inches.
1893	2·5	61·8	8·9
1894	0·5	57·0	10·9
1895	2·5	59·5	9·9
1896	2·4	58·9	11·3
1897	2·6	59·3	14·3
1898	2·6	60·3	5·8
1899	3·2	63·3	5·3
1900	1·2	59·7	6·0
1901	1·4	60·2	11·1
1902	0·8	57·5	9·5

RAINFALL IN THE DISTRICT, 1902.

	Feet above sea level	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Total.	No. of days with rain, -01 or more.	Greatest fall in one day.
Summit of Tyle Brith Average	2350	4.89	3.34	3.61	4.12	3.14	5.45	2.24	4.24	3.04	8.36	7.33	7.37	57.90	...	...
Nant Penig Average	2000	6.78	3.38	4.98	3.51	4.51	5.09	2.08	4.23	2.71	7.46	6.54	9.63	61.09	...	...
Beacons Reservoir Average	1240	6.00	3.56	4.84	3.80	3.85	4.55	2.43	3.95	3.03	8.17	6.74	8.92	56.84	...	...
Pontlluent Wen Reservoir Average	1255	7.45	5.18	5.59	4.97	4.09	4.00	5.15	7.74	5.26	7.86	7.83	10.32	75.44	209	{ Oct. 13th.
Blaenavon Average	1135	4.74	3.06	3.55	3.29	3.33	4.57	2.87	3.47	2.76	5.86	6.68	5.31	49.49	168	{ 1.15 Dec. 1st.
Cantref Reservoir Average	1120	5.86	4.12	3.96	4.04	3.46	3.18	4.03	6.52	4.40	6.91	6.71	8.48	61.67	170	{ 1.76 April 22nd.
Dowlais Average	1084	4.91	3.60	3.59	3.07	2.96	2.64	3.46	5.01	3.42	5.52	5.54	6.88	50.60	196	{ 1.55 Dec. 16th.
Tredegar Average	1024	3.21	2.96	4.97	4.17	3.46	3.77	2.12	5.29	3.49	4.93	7.00	5.28	50.58	183	{ 1.51 Nov. 8th.
Glyncorrwg Average	717	8.74	3.51	5.08	5.02	4.20	5.12	2.65	4.74	2.53	9.18	6.68	8.80	66.06	175	{ 1.66 Nov. 8th.
Bute Merthyr Average	670	5.30	3.74	4.89	4.11	3.88	4.94	3.69	4.17	2.77	7.83	7.81	11.07	81.93	195	{ 2.53 Oct. 14th.
		7.68	5.18	5.63	4.59	3.96	3.61	4.80	8.47	5.22	8.50	8.34	9.45	63.58	199	{ 2.49 Dec. 16th.

RAINFALL IN THE DISTRICT, 1902.

	Feet above sea level	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Total.	No. of days with rain, or more.	Greatest fall in one day.
Llanid Reservoir Average	582	4.71	2.98	4.00	3.72	2.92	4.00	3.51	5.64	3.37	5.67	5.34	6.52	51.68	163	{ 1.26 Dec. 17th
Shirenewton, Chepstow Average	530	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Aberdare ...	431	3.32	2.96	3.80	2.80	2.90	4.15	2.21	2.85	3.09	4.98	5.98	5.56	44.40	189	{ 1.04 April 21st.
Aberdare ...	...	5.82	3.96	4.39	3.43	3.24	2.53	3.55	5.37	3.80	6.09	6.32	8.29	56.79	183	...
Aberdare ...	430	5.11	2.77	3.43	2.80	2.69	3.15	1.56	1.76	2.35	3.80	5.64	5.96	40.97	138	{ 1.15 Jan. 1. Sept. 22
Aberdare ...	...	5.26	4.09	4.69	2.18	2.98	2.23	3.22	4.78	3.66	5.90	5.75	8.55	53.99	155	...
Chepstow ...	390	2.06	2.08	2.37	2.30	1.75	2.54	1.86	3.50	2.52	3.77	3.14	3.88	31.77	149	{ 1.21 Oct. 14th.
Chepstow ...	...	3.31	2.50	2.19	2.25	2.28	2.30	2.54	4.22	2.91	4.36	3.55	4.53	36.94	173	...
Llanfrechfa Grange Average	336	2.17	2.26	2.45	2.40	1.81	3.70	1.59	4.18	2.83	4.39	4.18	4.37	36.23	175	{ 1.27 Oct. 10th.
Cowbridge ...	...	3.48	2.69	2.82	2.50	2.49	2.21	3.04	4.12	2.98	4.14	4.09	4.91	39.47	166	...
Cowbridge ...	315	2.34	1.72	3.07	2.33	2.32	3.47	2.27	3.71	2.78	3.16	5.05	4.58	36.70	192	{ 1.29 Nov. 8th.
Cowbridge ...	...	3.53	2.81	2.83	2.68	2.19	2.31	3.03	4.66	3.43	4.78	4.28	5.41	41.96	190	...
Ystradgynbach ...	315	2.76	2.92	3.50	3.63	2.09	3.59	2.16	4.86	2.29	4.90	5.50	6.15	44.35	159	{ 1.33 Dec. 1st.
Ystradgynbach ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Chepstow ...	310	1.90	1.83	1.96	2.08	1.90	2.99	1.36	3.12	2.02	3.43	2.70	3.31	28.60	160	{ 1.07 Oct. 13th.
Chepstow ...	...	2.90	2.26	2.32	2.30	2.25	2.25	2.58	3.70	2.47	3.71	3.20	3.90	33.84	162	...
Pontypridd Reservoir Average	300	2.97	2.77	2.76	2.32	1.77	2.03	2.23	3.92	2.97	5.98	3.46	3.91	36.69	129	{ 1.32 Oct. 13th.
Pontypridd Reservoir ...	...	5.47	4.14	3.41	3.51	2.67	2.99	2.96	5.78	4.41	6.24	5.72	7.54	54.84	159	...

RAINFALL IN THE DISTRICT, 1902.

	Feet above sea level	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Total.	No. of days with rain, .01 or more.	Greatest fall in one day.
Talygarn ... Average	250	4.16	2.13	4.16	2.84	2.54	3.63	2.73	3.86	3.30	4.04	6.55	8.30	48.24	190	1.69 { Dec. 2nd.
Ystalyfera ... Average	240	4.47	1.93	4.93	3.42	3.47	3.38	2.85	3.51	2.88	6.91	6.31	6.00	50.06	187	1.99 { Oct. 13th.
Llandilo Court ... Average	207	1.61	1.69	1.97	1.73	1.90	1.81	1.13	4.44	3.08	4.48	3.97	1.44	29.75	144	1.91 { Oct. 10th.
Neath ... Average	204	2.76	2.03	3.49	3.05	2.83	3.64	3.16	3.26	1.96	5.01	5.17	4.19	40.54	203	1.97 { Oct. 13th.
Barry ... Average	191	2.31	1.09	2.35	1.73	2.46	2.62	1.69	3.14	2.83	3.11	4.13	3.41	30.86	193	1.11 { Oct. 9th.
Rumney, Cardiff ... Average	177	2.01	1.44	2.82	2.23	2.11	2.68	1.76	4.96	1.84	3.58	4.91	3.68	33.91	206	1.30 { Nov. 8th.
The Hendre, Monmouth ... Average	176	1.03	1.33	1.56	1.77	1.93	2.20	.64	3.35	2.00	3.52	2.61	1.80	23.63	180	1.14 { Oct. 9th.
Llanishen Reservoir ... Average	155	1.98	1.60	2.50	2.32	1.91	2.54	1.83	5.94	2.77	3.51	4.83	4.00	35.33	192	1.47 { Nov. 8th.
Lisvane ... Average	150	1.65	1.55	2.45	2.18	1.79	2.48	1.72	5.94	2.49	3.23	4.60	3.87	33.85	192	1.49 { Aug. 14th.
Heath Filters ... Average	132	2.06	1.66	2.81	2.54	2.23	2.72	1.79	4.21	2.68	3.51	4.75	4.08	35.13	188	1.47 { Nov. 8th.

RAINFALL IN THE DISTRICT, 1902.

	Feet above sea level	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Total.	No. of days with rain, or more.	Greatest fall in one day.
Fonmon Castle ... Average	130 ...	2.50 2.92	1.33 2.87	2.35 2.69	1.30 2.39	2.37 1.75	3.33 1.84	2.32 2.60	2.74 4.22	3.21 3.13	3.09 4.53	4.56 3.78	3.63 4.91	32.72 37.63	163 *167	1.37 { Sept. 23rd.
Cogan ... Average	121 ...	2.10 2.07	1.21 2.28	2.52 2.24	2.02 2.17	1.77 1.78	2.25 1.86	1.93 2.96	3.46 3.73	3.00 2.90	3.45 3.78	4.03 3.30	3.47 4.08	31.21 33.75	203 174	1.07 { Nov. 8th.
Llwynnarth ... Average	72 ...	1.95 3.01	1.37 2.44	2.43 2.53	1.99 2.30	1.91 1.95	2.78 2.01	1.64 2.86	4.97 4.14	1.87 2.85	3.28 4.03	4.29 3.45	3.94 4.62	32.52 30.19	183 182	1.41 { Nov. 8th.
Ely ... Average	53 ...	2.94 3.38	1.83 2.56	2.86 2.78	2.26 2.42	2.46 2.13	2.71 2.15	1.98 3.13	3.96 4.59	2.67 3.23	3.57 4.36	4.63 3.82	4.01 4.96	35.15 39.51	203 185	1.29 { Nov. 8th.
Cardiff Castle ... Average	38 ...	2.19 3.00	1.70 2.40	2.71 2.50	2.51 2.23	2.80 1.97	2.72 2.18	2.03 3.03	3.84 4.18	3.11 3.07	3.56 4.13	4.53 3.60	3.53 4.37	35.23 36.66	179 176	1.07 { Nov. 8th.
Porton (Mon.) ... Average	27 ...	1.86 ...	1.25 ...	1.88 ...	1.69 ...	1.81 ...	2.64...	.96 ...	3.36 ...	2.12 ...	2.45 ...	2.69 ...	2.74 ...	25.25 ...	154...	.88 { Oct. 9th.
Porthcawl ... Average	...	1.96 ...	1.42 ...	2.20...	.86 ...	1.93 ...	3.20 ...	2.00 ...	2.69 ...	2.23 ...	3.26 ...	3.84 ...	3.44 ...	28.01 ...	173...	.81 { Oct. 13th.

NOTE.—Average Rainfall is for the 14 years 1888-1900, unless otherwise indicated.

*15 years—1890-1901.

†10 years—1892-1901.

IN MEMORIA—JAMES BELL, C.E.

Born February 13th, 1839. Died April 11th, 1903.

By C. T. VACHELL, M.D.

By the death of Mr. James Bell the list of original members of the Society is reduced to three, having stood at 26 at the foundation of the Society in 1867—the Veterans remaining with us being Dr. William Taylor, Dr. Bush, and Robert Drane, F.L.S. It is true that our Annals do not record great deeds done for the Society by Mr. Bell, nevertheless his worth was recognised by the Committee, and on two separate occasions he was urged to accept the Presidency.

He was however of a singularly reserved and retiring character, and he could not be persuaded to take a front place. He acted on the Committee for 36 years, and until his removal to Barry regularly attended meetings. He was a consistent supporter of the aims and objects of the Society, and whenever his professional knowledge could be brought to bear he was keen to do his part—thus for instance he took a leading part in mapping out for the last edition of the Ordnance Survey Maps those fragments of Ancient Monuments, &c., which had not previously been noted.

Mr. Bell was born in 1839 at Canonbie, Dumfries-shire, and came to reside in Cardiff in 1866, practising as a Civil Engineer. In 1893 he was appointed Resident Engineer to the Barry Railway Co., and this appointment he retained until his death.

One of his more important works was the restoration of the Porthkerry Viaduct in 1900, after its unfortunate failure in 1897.

His genial disposition won for him many friends, but his domestic life was unfortunately saddened by repeated and heart-breaking bereavements.



JAMES BELL, C.E.

THE ORIGIN OF THE PHYSICAL FEATURES OF SOUTH WALES.

By F. T. HOWARD, M.A., F.G.S.

I. INTRODUCTION.

In the early days of geology, it was customary to explain the origin of the surface features of the earth as resulting from great cataclysms. If a hill presented an uncommon outline, it was thought to be due to a volcano. The existence of a gorge was referred to an earthquake,* and of a wide valley to the Universal Deluge.

But as the science of geology has become more exact, the changes of the past are explained by the changes taking place before our eyes, and the production of landscape is mainly ascribed to the slow but persistent action of rain and rivers, which themselves cause disintegration of the rock, and carry away to the sea both the products of their own destruction and those of other agents of denudation. Much, of course, depends on special circumstances. The character of the rock masses, their hardness and variability of structure and the manner in which they rest, all take part in the evolution of scenery.

* Theophilus Jones, in his History of Brecknockshire, writes as to the origin of the Taff Valley: "This convulsion formed the present Vale of Tâf, and precipitated that river into a channel at least 100 yards below; the explosion, or rather the steam arising from it, as it rent the rocks on each side, threw large fragments of them in a confused heap in the manner they appear as we begin to descend to Coed-y-Cymer, and left scattered upon the surface those immense masses of what mineralogists called plum pudding stone, slaked lime, rubbish and earth, appearing like the ruins of old castles, and lying in shapeless lumps below the upper stratum or wall of rock, and on which the action of fire is evidently discernible. Passing on to Merthyr the agitation continued taking a more southern direction, shown by the course of the river until it finally burst open the passage at Castell Coch and the opposite mountain, at one time apparently united, and here it wasted its fury."

The literature of the subject in respect to our island is extensive. I would principally direct your attention to the list of papers and books on page 51. "The Origin of the River System of South Wales," by Mr. Aubrey Strahan, read before the Geological Society in May, 1902 (after this paper had been prepared), embodies the results of the most recent investigations, and has given rise to much discussion. I have made full use of the information given by him in preparing the paper for publication.

II. GENERAL DESCRIPTION, ESPECIALLY INDICATING THE INTIMATE RELATION OF THE DIRECTIONS OF MOUNTAINS AND RIVERS.

South Wales may be divided into two regions—the uplands, comprising the country of the coal measures and the older rocks to the north; the lowlands, which lie near the coast, including the Vale of Glamorgan, the Gower Promontory, and the southern portion of Pembrokeshire.

"Broadly considered," says Professor Galloway, "the surface of the coal measures may be described as a great plateau lying at an elevation of from 700 to 1,200 feet above sea level and intersected by a series of more or less parallel valleys with steeply sloping sides, which have been excavated to a depth of some 500 to 800 feet below the general level."

The presence of these valleys has determined the lines along which the coal pits are arranged, and the positions of roads, railways and canals, and has greatly influenced the settlements of man. In consequence, it is strongly impressed upon the minds of those living near the coast, that the hill country of South Wales is broken up by the streams into spurs trending in a general way N. and S. But if an observer penetrates into the upland counties of Radnor, Brecknock, and Caermarthen, from the great plain of England or from the mountain groups about Plynlimmon he will be struck by physical features of a different type. Valleys opening southwards are found with

ease, but they sink into insignificance by comparison with the greater valleys into which their occupants discharge their waters. The axes of these greater valleys usually pursue an E. to W. or E.N.E. to W.S.W. direction, and are parallel to those of the more important mountain ranges.

The more closely the subject is studied, the clearer it becomes that some of the valleys exhibit close adjustment to the structure of the rocks. The range of Mynydd Eppynt and the Radnor Hills ends abruptly on the N. against the valleys of the Yrfon and the Ithon; the escarpment of the Old Red Sandstone produces the long range of Fforest Fawr and the Black Mountains which form the south wall of parts of the Sawdde, Usk and Wye Valleys; the Pennant escarpment abuts on the Aberdare Valley, and the Precelley and Llanlawr Hills once bounded a lost continuation of the Nevern. Other streams on the contrary seem to care nothing for obstacles lying across their track; they steer their paths directly towards the ridges, and pass right through them in narrow defiles. With such we are familiar in the Taff outlet through the Mountain Limestone ridge at Castell Coch, in the Rhymney gorge at Machen, and, on a grander scale still, in the Usk gorge above Crickhowell and those of the Wye below Builth and near Chepstow.

In these features Wales is not peculiar, though an observer who travels much in England will not fail to observe many points of difference. He will note that the hill ranges in England fall into three sets. One group includes the Mendips and the Cheviots, which lie along E. and W. axes parallel to that of the South Wales coalfield and its accompanying ridges; another group follows a N. and S. direction, as for instance the Pennine Range and the Malvern Hills, traceable as to direction at least in South Wales in the folding which divides the coalfield into two parts, and which converts it into a basin by bringing up older rocks to the surface in Monmouthshire. (Plate V., Figs. 1 and 2.)

The third group, to which the majority belong, points to the N.E. and S.W. The hills of the first two groups are mostly

24 *The Origin of the Physical Features of South Wales.*

composed of hard and ancient rocks, associated with mining industries, while those of the third are soft and of newer geological formations, and lend themselves more to purposes of agriculture.

The northern edges of the hill forming strata of the third group rise sharply from broad flats of low-lying ground, while they are covered to the S.E. by beds of later date, also producing edges more or less pronounced and parallel to the first. Thus the Bathstone forms the broken line of the Cotswold Hills, the Lincolnshire Wolds, and the Moors of N.E. Yorkshire. The edge of the Chalk is represented by the Chiltern Hills, the East Anglian Heights, and the isolated Yorkshire Wolds, while the same rock is brought up again by a rock fold, the crest of which has been removed by denudation, and the two broken lips are left as the North and South Downs.

Rocks newer than Coal Measures only occur in South Wales along the coastal plain of the Vale of Glamorgan, but, according to Mr. Strahan, though the newer rocks are no longer preserved to produce escarpments, yet the earth movements which brought into being the central ridge of the Isle of Wight caused minor bucklings in South Wales, sufficiently important to influence both the directions and the lengths of the rivers.

Thus of the three sets of ridges, the E. and W. largely predominates in South Wales, while the other two also occur in a minor degree.

In England, most of the great rivers run parallel to the ridges for the greater part of their courses. Thus the Trent, for the major portion of its length, follows the escarpment of the Bathstone, while in the opposite direction, the Tewkesbury Avon gathers up the drainage from the continuation of the same uplands. The streams of the Wash steer their courses parallel to the Chalk Hills, while the Ouse skirts the edge of the East Yorkshire Hills to join the Humber.

In South Wales this type is represented only by short segments of the river courses, such as the Usk above Brecon, the Wye between Boughrood and Hereford, and the Towy

between Llandovery and Caermarthen. A second and prevailing type is well exemplified in—

- (a) The group of parallel streams which drain North Brecknockshire ;
- (b) The streams of Fforest Fawr, some of which join the Usk and others the Monnow ; and
- (c) The rivers of the coalfield.

Thus in most areas the streams fall naturally into two divisions nearly at right angles to one another.

Valleys which run parallel to the ridges are often spoken of as *longitudinal*, and those which cross them as *transverse*. Longitudinal valleys are not difficult to understand, as they follow the outcrops of soft rocks, and avoid the hard ones on either side ; but what can the transverse courses mean ?

The opinion of experts is unanimous that such rivers must date back as to their origin, to a time when the land surface was at least on the same level as the tops of the now existing hills, and in some cases much higher still, though the land as a whole may not have stood as high out of the sea as it does at the present time. (Plates III. and IV.)

III. GEOLOGICAL HISTORY.

It is strange to think that much of what is now land was for long periods covered by the ocean. During the earliest geological epochs the greater part of South Wales was under water, and it was not until the period of the Coal Measures that it formed an appreciable portion of the land mass. None of the great land features had then been evolved.

When the Pennine Range first rose into importance Birds and Mammals were unknown, Reptiles were few and unimportant, and the Labyrinthodont and his Amphibian relatives held mastery over the world, and about the same period the great plain of Cheshire and the Border Counties lay beneath a broad sea separating the Pennine District from the Palaeozoic uplands of Wales. We know that the basins of the South Wales coalfield had already come into existence, and Mr. Strahan has calculated

that between the end of the Coal Period and the deposition of the newer red rocks of Llandaff and Radyr, a thickness of 7,700 feet of rock had been removed from the surface at the point where Cardiff now stands.

It was suggested by Sir A. Ramsay, that some of the existing rivers of the South Wales Coalfield may date back as to their origin to this particular period, when the rocks were tilted up with a southerly dip, and the surface acquired a slope in the same direction.

Mr. Strahan, however, has shown that the direction of the dip of the strata and the directions of the streams are too divergent to suppose that the two are intimately connected, even though some of the gorges along the southern edge of the coalfield may have been excavated so far back in geological history.

During Mesozoic times, owing to a general subsidence, the greater part of the country, except the most elevated portions, gradually sank beneath the waters of the ocean and was buried under a deposit of the shells and hard parts of animals inhabiting those waters—a deposit now hardened into rock which remains with us, and is known as the Chalk.

How far this deposit cloaked the surface of what is now the centre of Wales, it is impossible to say. All traces of the Chalk, if it ever was deposited over the coalfield have disappeared.

At last a reverse movement set in. The ocean bottom of Chalk, concealing all underlying structures, was raised into a lofty upland, and produced a great continent, occupying what is now the East Atlantic and much of Europe.

It was during this period of upheaval, about Miocene times, that the present river systems of England and Wales began their development, the first streams flowing over the surface in a S. or S.E. direction. The streams of South Wales still maintain that direction.

Some streams were particularly influenced by the earth-movements, which, besides raising up the land as a whole, were

continually producing ridges in direction across the stream courses. Sometimes the streams were able to channel through the ridges as fast as the rocks were raised above the general slope of the river bed, but in a few cases, failing to cut through them, they turned sideways parallel to the ridges and along the hollow which is the natural counterpart of the rock arch. Illustrations of this are to be found within the region of the coalfield.

In certain portions of England it is probable that at an early stage in the period of their continental connection, the Chalk coverlet was entirely denuded from the old land surface and the drainage of such areas adapted itself to the structures of the rocks thus laid bare. This applied in a marked degree, according to my interpretation, to the region with which I am dealing.

Later movements of elevation and depression have taken place, which have emphasized the individuality of some streams, assisting some to cut down more quickly and to gain advantage by gathering up the tributary streams of other rivers. But more important still are the results of the Glacial Epoch, when deposits were laid down, obscuring the pre-existing features, and which remain in certain areas until now. And equally important are the results of the subsidences which have taken place during the period of Man's occupation.

IV.—RIVERS OF SOUTH WALES.

I conceive that the present river systems of South Wales, like those of England, began to develop with the great uplift during the Pre-Pliocene times. Short rivers may have existed during the Cretaceous Period on the islands corresponding with the elevated tracts of to-day, but they cannot be identified among the streams of Central Wales. As already pointed out, it is probable that the newer beds were stripped off during the upheaval or soon after, thus allowing the old sea-bed of Palaeozoic rocks to appear at the surface. The stream evolution owes as much to this fact, seeing that a number of

alternating hard and soft rocks were thereby exposed, as it does to the tilting of the strata when the Continental Period began.

Thus, the exposure of a wide strip of soft clay and sandstone, known as the Lower Old Red Sandstone, lent itself to the development of a series of longitudinal valleys which now separate the drainage of Central Wales from that of the coalfields; the outcrop of the softer Silurian, a few miles to the north, served equally well for the growth of other longitudinal streams which divide Central Wales from the North Brecknockshire hills.

There is nothing improbable in the suggestion, that the transverse streams of the coalfield originally had their sources among the hills about Plynlimmon, and that, assisted by movements especially in an upward direction, longitudinal tributaries grew in the manner described, and eventually diverted the upper waters of parallel streams. The stream which carved the gorge of the Wye below Builth was captured by an offshoot from the Lug, which, most likely, had been able to deepen its course more rapidly than its brethren to the west, because of the thinning out of the hard and resisting Old Red Sandstone conglomerates near its course. The Wye below Hereford is obviously the lower course of the Lug.

The stream which excavated the Brecon to Crickhowell gorge—crossing, be it noted, at the eastern boundary of the massive Coal Measure sandstones, and the limestones and grits which underlie them—had secured, by a long tributary on the west, a great volume of water from the streams of the northern slopes now known to us as the Honddû, Yscir, Brân, and Cilieni. Similarly a stream occupying the position of the Gwili, marking another line of weakness between the two portions of the coalfields, sent off arms to the east and west (the fore-runners of the modern middle Towy and the Tâf) partly along the outcrop of the same soft red rock, which secured the upper drainage of a large number of south flowing streams. And as a consequence of the development of these secondary

streams, deep and wide valleys have been excavated with steep faces on the one flank indicating the edges of hard strata, and a gentle slope on the other, marking the area occupied by the soft rocks through which the stream courses have sunk. (Plate VI., Figs. 1—6).

It must not be expected that the flanking escarpment is straight and unbroken. The crest of the Brecknock Beacon Range is at least five miles south of the course of the Usk. The river in all probability once ran at the base of the escarpment which has been slowly worn back by innumerable streamlets. These have gradually grown into considerable rivers by the diversion of waters, which, before the retreat of the escarpment, found their way to the Glamorgan rivers.

In this way the rivers of the coalfield were cut off, by the growth of the longitudinal portions of the Wye, Usk, and Towy, from the upper parts of their own valleys; the waters of those upper valleys are collected to escape seawards by the three great streams mentioned; and the Glamorgan rivers slowly but surely are losing both length and volume by the ravages of short streams along the northern scarp of the great mountain range of South Wales.

Standing on the Abergavenny Sugar Loaf and looking north, the valleys of the Grwyne fawr and the Honddŷ appear almost to unite between Partrishow and Cwmyoy; yet they part ways along a hollow which, like others, trends in an E.N.E.—W.S.W. direction, the former stream turning abruptly to join the Usk, the latter to the Monnow.

The Usk is evidently an ancient stream. It has rounded off many angles in its course, and has developed many side tributaries even in its gorge track. By means of the Collwng and the Crawnnon it has captured the head waters of the West Monmouth rivers and the Ebbw fach and Afon Llwyd streams have been further robbed by the Clydach, which joins the Usk a little above Abergavenny (see Geol. S. Wales Coalfield.—Part II., pp. 9-93). "The gap in the Pennant escarpment traversed by the Ebbw fach," says Mr. Strahan, "is more com-

parable in its great width and depth with those of the Ebbw, Sirhowy, and Rhymney, than with those of the Rhymney Taff, and Bargoed Taff. This disproportion in size of river to valley suggests that the gap owes its origin to a larger flow of water than that which now passes down it."

The curious bend of the Sirhowy to join the Ebbw at Risca, and the parallel one of the Rhymney from Caerphilly towards Machen remain unexplained, though I hazard the suggestion that they are due to movements similar to those which turned the Neath and Tawe. It is worthy of notice, that at the points where the Taff and Rhymney break through the limestone of the south crop, the limestone outcrop is duplicated, and consequently weakened, while at the Risca gorge of the Ebbw the outcrop is much reduced in width and apparent thickness.

The Taff Vechan was probably diverted to its greater neighbour originally through swallows at the point where the Carboniferous Limestone crosses its track. The disappearance of surface streams here is still a characteristic habit, to the disadvantage of the Dolcoed reservoirs, from which water escapes by underground channels.

Both the Taff Vechan and Taff Vawr are in sharp contest with the later developed group of tributaries to the Usk, which rise in cwms on the north side of the Brecknock Beacons. Of these the Tarell has been the most successful, having forced its way into the hollow which lies between Penmilan and Rhôs-drîngarth, immediately above the Cardiff reservoirs. But while the Taff loses volume slowly to the Usk, it has gained much from parallel streams to the west. These streams, being retarded in their downward cutting by the greater thickness and resistance of the Pennant grit in the central region of Glamorgan, fell easy victims to the tributaries developed along the softer bands. Chief among these is the Cynon, which has gained considerably through the development of its tributaries rising along the Pennant escarpment of Craig-y-llyn, and which are, to a large extent, responsible for its marked character. The Rhondda was thus separated, according to Professor

Sollas, from the lower portions of its valley, known to us as the Ely. Similarly the Corwg was turned sideways by the Avan, instead of continuing as before along the primitive Llynfi Valley.

The Ogmore, Garw and Llynfi are all N. and S. streams, captured by an arm of a stream, which, like the Ely at Llantrisant, had discovered at St. Bride's Minor an ancient gorge through the Carboniferous Limestone, filled with conglomerates and other rocks of later date, and had found it easier to clear out the newer beds than to carve a new passage for itself through the limestone.

It is to the Neath and Tawe that Mr. Strahan especially points in proof of his theory, that the "subsidiary axes of elevation (in Post-Oligocene times) formed minor water partings or locally diverted the rivers in their courses from the major axis." The upper portions of these streams, like many others, flow in a direction S. or S.S.E., but on reaching the zones of highly disturbed strata, they turn sharply and take new directions, mainly S.S.W., instead of flowing right across them like the Taff. This disturbance would assist in disorganizing the system of streams about Craig-y-llyn. Parallel to these streams, and apparently owing their directions to like causes, are the Llwhchwr and the two Gwendraeth rivers.

The Cleddau is an interesting example of stream development. Numerous streamlets flow southwards from the Precelley Hills, until they reach a zone of intense earth movements, to which reference was made by Mr. E. W. Small, C.N.S. Trans., vol. xxxiv. [see 2 plates]. Here the directions of the two branch streams change; they bend towards one another and meet at a point immediately east of the outcrop of the Talbenny-Johnston coarsely-crystalline rock. The Dau-Cleddau continues to follow this line southwards, avoiding the igneous mass until it passes out of the area of greatest complexity, when immediately it turns westwards parallel to the axes of movement into Milford Haven.

Thus many of our rivers still bear the impress of their origin during the Continental Period as parts of a "superposed drainage, settling down into unknown structures through an unconformable series, such as must have elevated this region." Some have sunk into insignificance as their environment with its everchanging conditions proved unfavourable; others have grown by adapting themselves to the surface of the Palaeozoic rocks, and by constant interference with the supplies of other streams.

V. CONTESTS BETWEEN STREAMS.

The struggle for supremacy between the rivers is very keen. Like hill robbers they are constantly making sorties, appropriating lands belonging legitimately to others. Where the water-divide is evenly poised, a gully cut during a thunderstorm may settle the direction of flow for ages.

A few years ago I noted, after a severe winter, how the breakdown of a cliff permitted a small stream, which had formerly joined the Neath, to form a small "pistyll" and to run down into the Tarell.

On the plains of Gwent, between Usk and Monmouth, the water-divides are ill-defined, and the tributaries of the Wye and Usk drain practically the same area.

The Senni has invaded the territory of the Neath, and the Cray, having robbed the Tawe of some of its headsprings, is now to be tapped by means of a reservoir, which will discharge its waters through a tunnel into the Swansea Valley.

The Wye, between Boughrood and Hereford, follows a longitudinal course, yet, contrary to the general rule, it adds little to its volume from south-flowing streams at the present time, seeing that it has itself been robbed by the Arrow, a tributary of the Lug, which has forced its way along a parallel line about three miles to the north.

One of the most interesting cases I have seen is at Llywel, between Llandovery and Brecon, where a mountain brook is forked by a heap of stones, one portion flowing to the Usk

and so to the Severn through Monmouthshire, the other by the Sawdde to the Towy and out to sea at Caermarthen. Originally the stream was a portion of the Usk system, but a rivulet flowing down the hillside behind Llandovery across soft rocks, cut a gorge through them, and thereby produced a slope which allowed water to escape seawards more rapidly than by the Usk.

At a comparatively recent date the mountain brook must have taken the new direction, as the inhabitants, for purposes of trade, can even now turn a portion of the water along its old channel by merely heaping up stones in the streambed.

A famous lecturer on the Story of a Raindrop put words into the mouth of the Nymph. As she fell she saw lovely pastures and pleasant sights, well-fed oxen, and plenteousness on every side, and she rejoiced that the lot of herself and her companions would be so pleasant on their journey to the sea. But just as they neared the earth the wind blew them over the mountain side, and they joined a stream which flowed with murky waters through industrial towns, its load of filth increasing until it joined the ocean. The story can be readily applied in South Wales. On the Caermarthen Vans the rain-drop may fall within the area drained by the Towy, which passes through beautiful scenery and rich lands; a puff of wind may send it a few yards further to fall on the mountain side, where the Usk has its sources, and then its course will carry it to the manufactories of Monmouthshire; a gale may divert its path to the Tawe or the Amman—streams which flow past collieries and smelting works almost from their sources.

VI. ORIGIN OF CWMS.

Where a district is composed of a series of alternating pervious and impervious rocks, springs are often thrown out along the outcrops of the less permeable strata. As nearly every coal seam is associated with shales, the springs define the coal outcrops with much closeness. A spring due to this

cause at the base of a cliff or escarpment may produce a hollow by the gradual falling in of the rocks about it, and, as a result, the layer along which the water flows to the spring is laid bare for some distance, and the spring itself retreats in proportion. The water will probably ooze out along the same band at several points within the hollow, which is enlarged by a continuation of cliff disintegration until it become a cirque or *bwllfa*. The major springs follow the direction of greatest dip of the rocks, and, in consequence of their retreat, the hollows are lengthened until the cirque passes into a long deep valley with almost perpendicular sides, to which the name Cwm is usually applied.

Such are the cwms which have been cut back into the Brecknock Beacons by the springs which feed the tributaries of the Usk (see Lord Avebury's "Scenery of Great Britain").

Cirques and cwms in various stages of development are numerous along the Northern scarp of the Black Forest. The hollows, which contain the pools Llyn Fawr and Llyn Fach above Hirwain, are cirques, and the Punchbowl and Craig-y-cwm in the limestone south of Abergavenny are examples of the same kind.

Mr. J. E. Marr has called attention to the fact that the highest points of a ridge usually occur at the heads of cwms, or at the junction of two cwms, where, from the rudimentary cirque, denudation followed the retreat of two springs instead of one. Thus Craig-y-llyn, 1,969 feet above sea level, directly overhangs the cirque of Llyn Fach, and Blaen-Rhondda above Treherbert seems to block Cwm-Rhondda, for which reason the navvies conferred on it the title of the "Eternal Buffer." Cribin is the highest point between Nantseri and Nantcynwyn, and Penyfan, the highest peak in South Wales, is at the junction of Cwmseri and Cwm-llwch.

VII. UNDERGROUND WATER CIRCULATION.

Dr. W. Williams, M.O.H. for Glamorgan, in his "Sanitary Survey of Glamorgan," showed clearly the consequences of

pumping in connection with the collieries of South Wales upon the underground water circulation. It is obvious that the large quantities of water raised at mines, such as Llanbradach and New Tredegar, and at works like the Severn Tunnel, must cause springs on the higher ground to dry up, and that much volume will be added to particular streams at the expense of others. It is possible for a stream to be swallowed entirely and on its reappearance at the surface to be quite outside its old valley system. A surface of clay absorbs little or no water; a limestone absorbs much. When streams run down slopes of sandstone and grit, they may cease to flow over the surface, if the covering to a limestone beneath becomes too thin, or is entirely removed. In such areas the ground is studded with huge funnel-shaped depressions and long valley-like hollows filled with blocks of stone.

These are numerous upon the uplands immediately to the N. and N.E. of the coalfield. Leland refers to them as primitive strongholds, each large enough to be capable of concealing 100 men. They are due to the solution of calcareous rocks along vertical pipes or joints. Their connection with the general drainage is not, at first sight, obvious. Often their presence on the hills is regarded as dangerous to the cattle, and farmers naturally fill them with waste and rubbish regardless of the consequences to the springs of the district. [For an excellent description of a concrete instance see "Geology of South Wales." Part II. Abergavenny, page 144.]

In the Vale of Glamorgan, where limestone rocks predominate, there are many "Sychnants," and it is only possible to explain the present irregularities of the surface, by a much more extensive system of surface streams than exists at the present time.

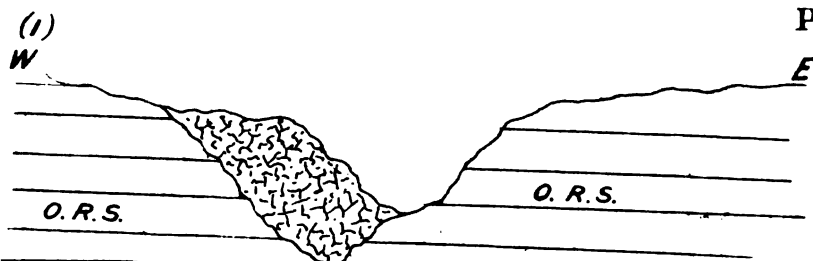
The disappearance and the sudden reappearance of streams are equally common. Along the stream from the Wentwood reservoir are several swallows, which become choked at times by accumulations of vegetation. So numerous are they on the limestone outcrop near Blaenavon, that it requires careful

arrangement to convey the water safely on to the surface of the shales on which the reservoirs are situated. Near the Neath, and on the limestone slopes north of Merthyr and Dowlais, many examples can be found, and at least one strong spring near Merthyr Mawr in South Glamorgan has been proved to be connected with the neighbouring river. A number of vertical pipes several feet in depth and up to two feet in diameter can be seen on the shore at the mouth of the Ogmore. In many cases the reappearing stream cannot be recognised as a continuation of one which has flowed above ground previously, and it is probable that many rivers developed as large subterranean streams, through the collection, in large rock joints, of water from many underground tributaries which had their sources at different points on the surface of a large tract of land.

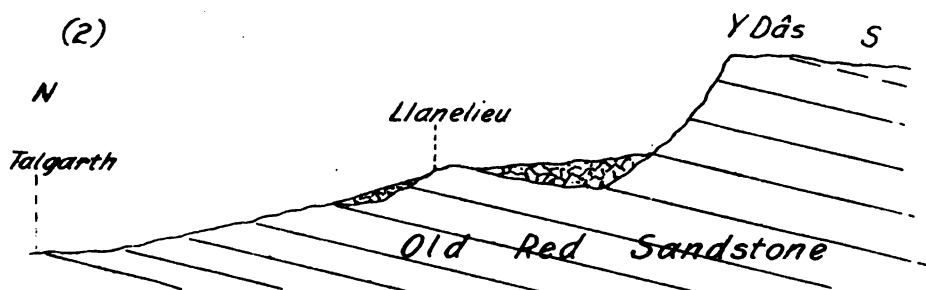
It seems likely that the Ewenny spring which, until lately, supplied Bridgend with water, was polluted from a distant source.

Some streams, which disappear underground, burst out at points in the same valleys; others escape in different directions. According to Mr. Cantrill the Byfre formerly ran directly to the Tawe through Nant Byfre; but its course about half way down became blocked by glacial debris, and the stream now escapes underground at Pwll Byfre to reappear in Ffynnon du, at a distance of one-and-a-quarter miles to the south of Nant Byfre.

Some underground channels, such as Cwm Ogof on the Neath, and that of the Bishopston Valley in Gower, can be explored. Some even have been the homes of man and beast, as King Arthur's Cave and Lady Park Cave, near Symond's Yat, and Hoyles Mouth near Tenby. The roofs of the others have collapsed and laid bare the old hidden watercourses, as portions of the Upper Neath and the Taff Vechan near its confluence with Taff Vawr, and probably the Afon Llwyd, which obtains most of its volume from underground.



*Horizontal section across Yscir fawr valley (diagrammatic)
showing glacial bank near Bwllfa uchaf*



*Horizontal section from the R. Llyfni to the Black Forest (diagrammatic)
showing glacial deposits.*

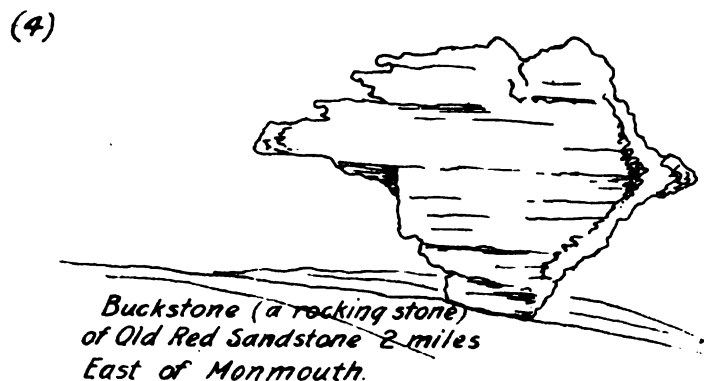
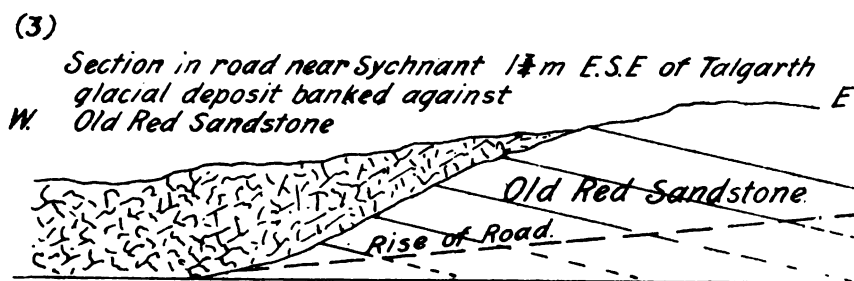


PLATE II.



SURFACE OF OLD RED SANDSTONE,
ABOUT $\frac{1}{2}$ -MILE SOUTH OF LLYN-Y-FAN-FAWR, ON THE BORDER OF
BRECON AND CAERMARTHEN, SHOWING GROOVES POINTING S.S.E.
AND POLISHED FACES PRODUCED BY ICE.

Photograph taken by Rev. L. O. Price, M.A., of Brecon.



FIG. 1.—An anticlinal fold denuded by the sea as it rises to the successive surfaces *aa*, *bb*, *cc*, *dd*.

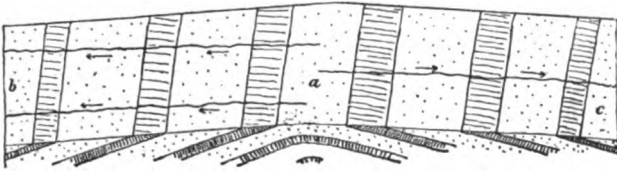


FIG. 2.—Section and plan of planed anticline with transverse streams flowing down the steep slopes across the strike.

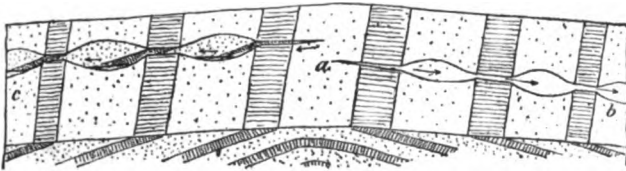


FIG. 3.—The widening of transverse streams when crossing soft rocks.

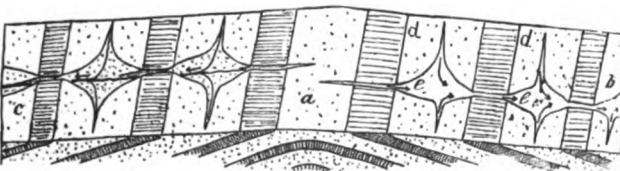


FIG. 4.—The origin of longitudinal or strike streams in the soft beds.

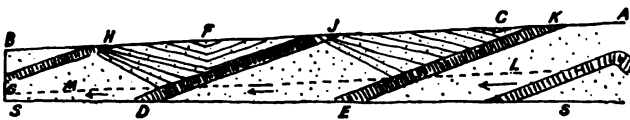


FIG. 5.—Section along a transverse stream showing its path *LM* and the gradual enlargement of the longitudinal streams which are tributary to it.

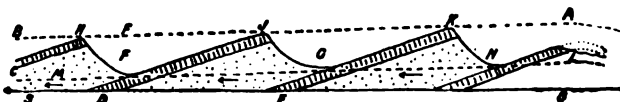


FIG. 6.—Outline of successive dip-slopes and escarpments produced by the joint action of the two sets of streams.

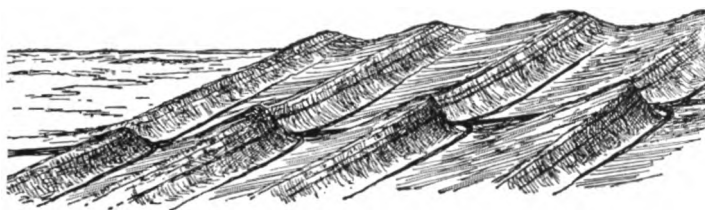


FIG. 7.—View of country made up of escarpments and dip-slopes with their transverse valley and eight tributary longitudinal valleys.

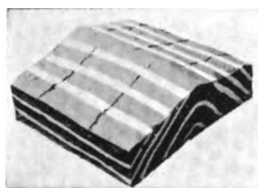


FIG. 8.

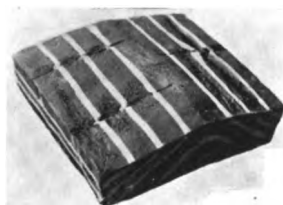


FIG. 9.



FIG. 10.

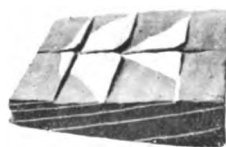


FIG. 11.

Four wood models illustrating the origin of dip-slope and escarpment.

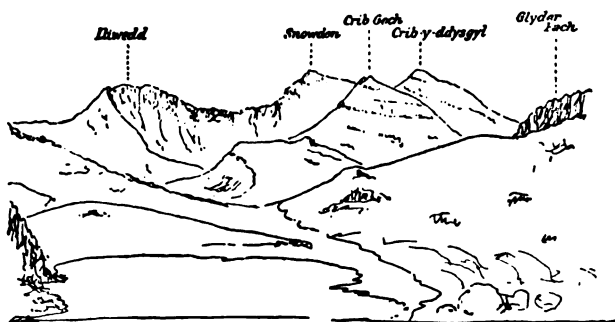


FIG. 12.—View of the Cwms of Snowdon, showing result of stream action on an escarpment.



FIG. 1.—ESCARPMENT OF MILLSTONE GRIT AT THE ROACHES,
NEAR LEEK, IN STAFFORDSHIRE.

Photographed by Mr. A. A. Armstrong.

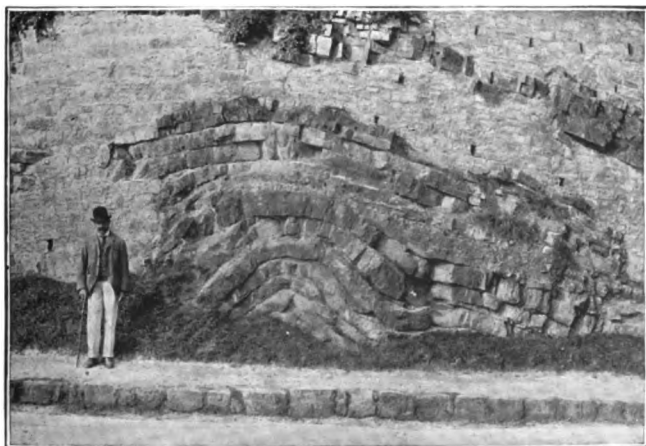
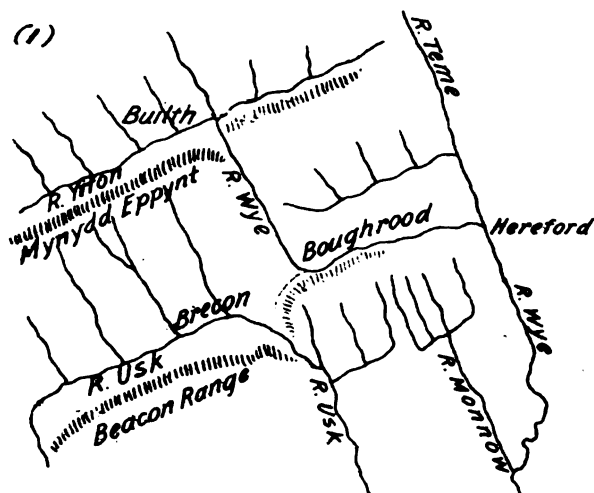


FIG. 2.—ANTICLINAL FOLD OF CARBONIFEROUS LIMESTONE AT
CHEPSTOW.

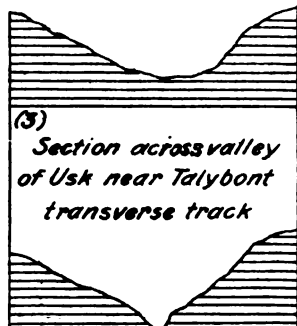
Photographed by Mr. H. L. P. Lowe.

(1)



(2)

Section across valley of Wye North of Boughrood transverse track.



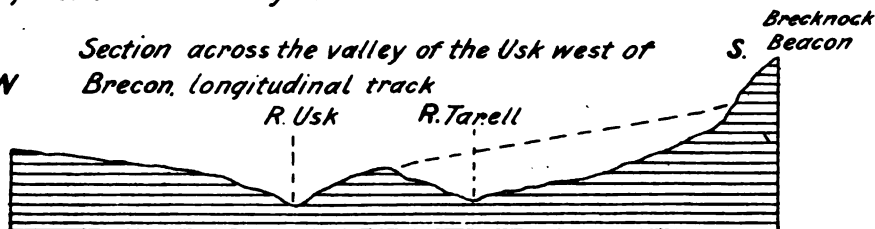
(3)

Section across valley of Usk near Talybont transverse track

(1) Diagram showing relationship of the Wye & Usk rivers to the escarpments & hill ranges.

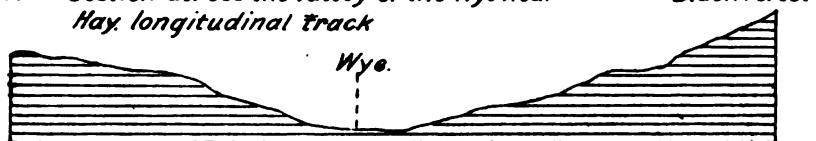
(4)

Section across the valley of the Usk west of Brecon, longitudinal track



(5)

Section across the valley of the Wye near Hay, longitudinal track



The transverse & longitudinal sections are drawn on the same scale.

(6)

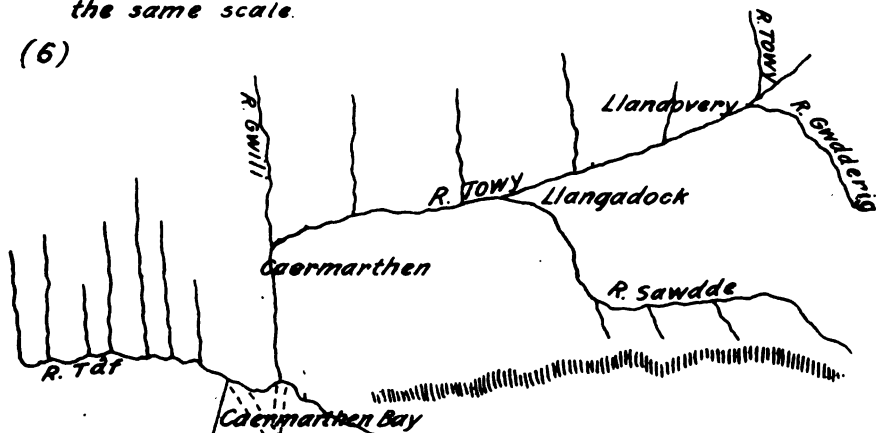
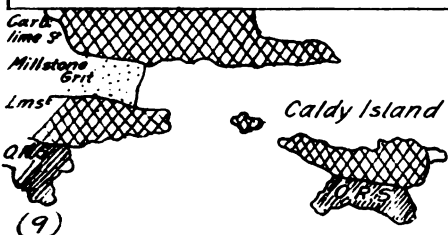
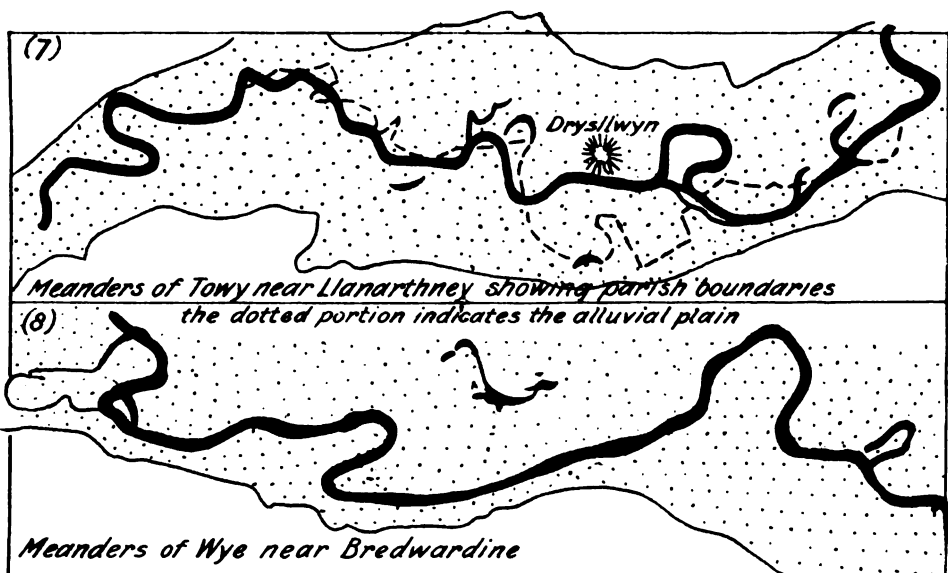
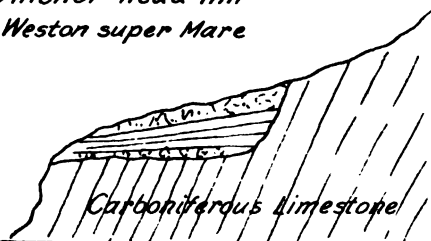


Diagram to show compound character of the River Towy.



*Raised Beach at
Anchor Head Hill
Weston super Mare*

(10)

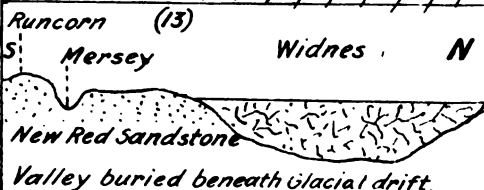


(11) Ramsey Island.



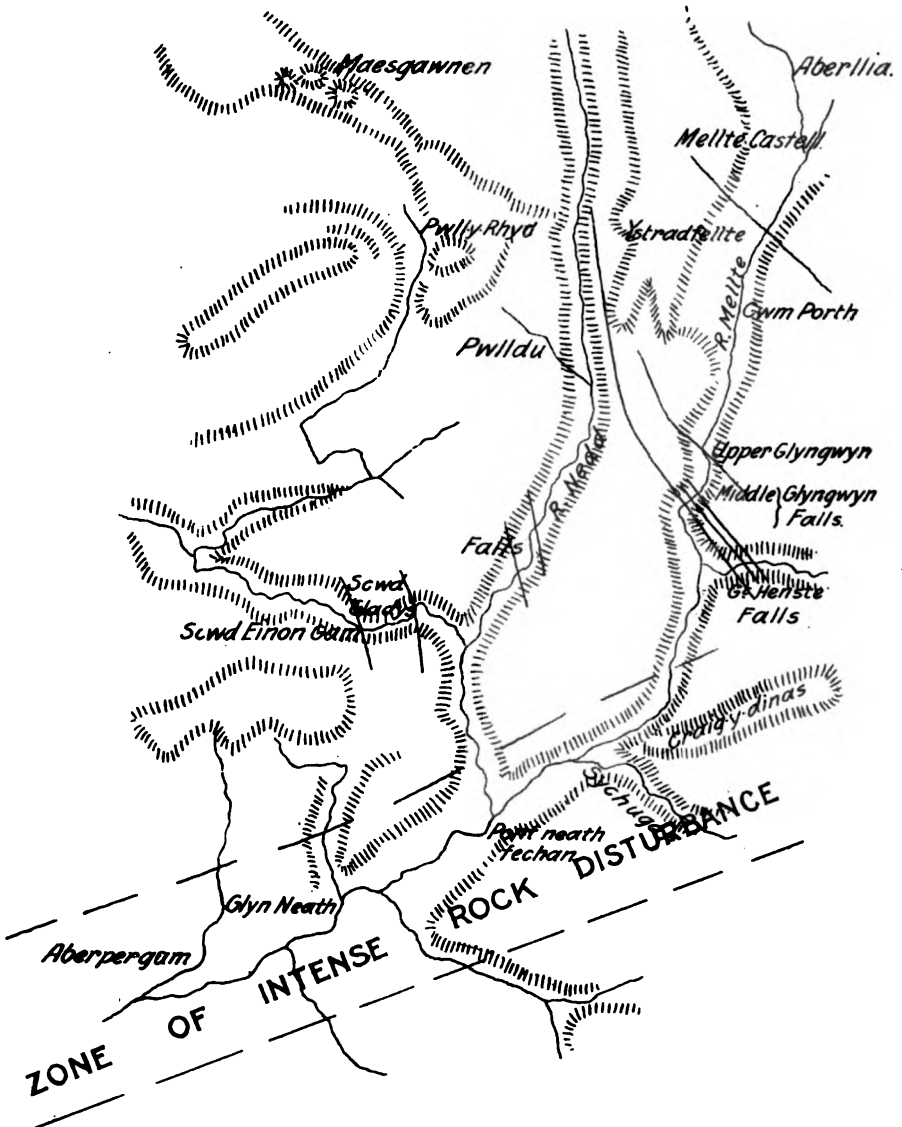
*Cave in Gower near Swansea
Raised beach on level
of floor*

(12)



(14)

Map showing faults & waterfalls in the upper parts of the Neath drainage system



VIII. VARIOUS STAGES OF RIVER DEVELOPMENT.

Rivers are very life-like in their habits. They exhibit the usual attributes of childhood ; they grow into maturity ; they glide into the easy routine existence of old age, and they die a natural death.

In youth the irregularities, due to hard bands of rock crossing their tracks, are most marked—as the Americans say, the course is not graded—and each resisting layer, as long as it remains, produces a waterfall or a series of waterfalls. Thus the tributaries from the escarpments to the big longitudinal rivers, being the newest streams of the drainage areas, are characterized by waterfalls, while their parents are usually free from them. The matured stream, having removed the irregularities from its course, is actively engaged in deepening its channel to an even gentle slope from source to mouth, by which its velocity is gradually reduced.

The old stream finds it sufficiently difficult to carry away its load of debris seawards, and practically abandons the task of deepening its course. It lazily swings from one side of its valley to the other, enlarging its curves by the removal of material from one bank, and accumulating it on the opposite side until it produces a wide gravel-covered plain.

“ And so by many winding nooks he strays
With willing sport to the wild ocean.”

Unlike living creatures, however, the river at any stage may be rejuvenated, whilst to some extent preserving the characters of the period of life it had reached. Upheaval, increasing the differences between land and sea level, adds to the velocity of flow, and so to the cutting power of the stream. A stream with well developed meanders may receive a new lease of life, and while continuing in its curving path, may excavate a deep entrenched valley. Waterfalls, due to the cause described, characterize the streams of the northern face of the Black Mountains, tributaries to the Usk and the Wye, *e.g.*, Cwm Llŵch Falls and Ffrwd Grêch Falls near Brecon.

They are equally abundant in the mountain tracks of most streams. From the description of Mr. Gibson, I have adapted the following explanation of the scenery of the Upper Neath region. (Plates VIII. and X.)

The Millstone Grit here is divisible into three parts, each separated from the other by a series of shales.

The Sychnant crosses the upper Millstone Grit in Cwm Wyrfa, flows down a ravine cut in the shales, and down a fall in the middle grit of the series, and shortly after enters an impassable gorge in the bed of grit. Passing on to the limestone, it encounters a great fault, and disappears down a swallow hole at this point. In wet weather the water descends in a series of cascades more or less along the fault.

The Hepste keeps an underground course for a long distance, and issues about one-third of a mile below Cae Howel, the steep-sided ravine being in the lower Millstone Grit. The fall Ysgwd yr Eira is due to a lenticular bed of shale, while the stream cascades down the Clyn Gwyn fault, which throws down shales on the west against the limestone.

The Mellte, about two-thirds of a mile below Ystradfellte, enters a low wide cavern in dark limestone. About one-third of a mile further on it reappears, and crosses a fault, here obscured by glacial drift, on to the lower Millstone Grit. Near Clyn Gwyn the fault throws the grit down 30 feet westwards, and the shales having been removed, the stream leaps down the face of the fault on to the same bedding plane below. As in the case of the Hepste, the Clyn Gwyn fault brings shales against harder rocks, and the Clyn Gwyn falls result from the stream passing to the much deeper valley in the shales.

The little Neath follows a fault line for some distance, and its gorge is in light-coloured limestones. Below Pont Melin it seems to follow the uppermost bed of the lower Millstone Grit owing to the combined effort of the dip and a series of small faults. The lenticular bed of shale in the Millstone Grit produces a fall as in the case of Ysgwd yr Eira.

The chasm of Pwll-y-rhyd arises from the presence of strong joints in the limestone, and the cavern of the Mellte may have begun in this manner.

The Perddyn rises on the Coal Measures and near Dysgwylfa, passes on to the Farewell Rock, and forms a fine waterfall at Einon Gam in the lower part of that rock.

The deep ravine is cut in the shales, and at the Gwladys Fall the stream jumps from the middle grit over the shale to the lower grit.

Similar falls to those of the Neath occur on the Tawe, Llŵchwr and other streams, which cross the northern outcrop of the limestone.

Waterfalls may arise from other causes. Some result from the comparatively slow cutting of a transverse stream, the waters of which have been diverted by a longitudinal river, which, flowing along a course in soft rock only, quickly excavates a deep channel. The older streams now regarded as tributaries, for example the Cilieni which joins the Usk near Senny Bridge, often join the newer stream by a low waterfall. Other streams are often turned aside out of their true course by the action of a streamlet cutting back into an escarpment, and these diversions are marked by a waterfall. Again, the course of a stream may have become blocked for a short distance through glacial drift, and the water, having excavated a new channel, may rejoin the original course lower down by a fall.

It is obvious that the streams of South Wales as a whole have not advanced far into maturity. The streams are mostly rapid even near their mouths; the gradients are usually fairly developed, though throughout the whole course denudation is actively proceeding.

The more matured among the group are the Wye, Usk, Towy and Cleddau. The Towy especially, as may be observed from Penllan Hill, Caermarthen (Plate VII., Fig. 7), forms many meanders, and its gravel flats stretch from near Llangadock over its wide valley to the sea. Such streams as the Pennard in

Gower, and the Ely near Cardiff, meander greatly within the portions of their valleys, subject to the action of the tide.

Meandering is more characteristic of the longitudinal portion of a compound stream than of any other, as for example the Wye between Boughrood and Hereford. (Plate VII., Fig. 8.)

The influence of upheaval on a stream which has already formed great curves may well be exemplified by the Wye, which, from Ross to Chepstow wanders through a region of hard limestone in a channel some 800 feet deep.

The Usk, likewise, from Abergavenny onwards, winds mysteriously across a country composed of hard and soft rocks, regardless of structure or present physical features.

A stream near its mouth does little downward cutting, and it is not difficult to see that, where the land has been raised since the meandering has developed, the stream could not cut down lower than the level of the sea. The Wye, however, is tidal as far as Bigsweir, $11\frac{1}{4}$ miles from Chepstow. This can only be explained by a subsidence since the stream ceased to excavate its course. All the rivers of South Wales show evidence of a general subsidence in recent geological times. It is equally clear that the same thing happened before. Near Llantrisant, gorges through the limestone were for a long time buried beneath the Dolomitic Breccia (of which the Radyr stone is an example), which represents the wear and tear of a coastline (see C.N.S. Trans., vol. xxvii., part I, Geology of Barry Island).

IX. RESULTS OF GLACIATION IN SOUTH WALES.

One form of submergence is accountable for the fact that streams occasionally miss their way. During the Glacial Period, the icesheets which overspread South Wales deposited thereon a thick coating of clay and gravel, which completely masked the surface features of pre-glacial days. Frequently, too, the sharp line of demarcation between hill range and valley is obscured by heaps of glacial debris piled up against the rock faces. Such, for instance, is the origin of the slope

from Hirwain to Craig-y-Llyn. In England especially, buried valleys are not uncommon, some greatly exceeding in width and depth the new ones excavated by the streams, when they failed to discover their pre-glacial hollows. Thus at Runcorn the Mersey passes through a narrow passage in solid rock, while at Widnes a deep valley 3 miles wide is completely obliterated by glacial deposits.

In South Wales, however, while the surface features were equally obscured and the valleys filled with drift, the general trend of the country was not altered, and the drainage found its way as a whole into the old channels. In some cases, especially among the mountains, the slopes of post-glacial times have influenced the smaller tributaries, so that they run in slightly different directions to those which drained the same areas previously. But it is rare to find streams actually diverted from their paths. The Byfre, a tributary of the Tawe, previously referred to, is an example.

Most of the valleys still contain mounds and irregular heaps of drift, and portions of the valleys of the Neath and Tawe as well as those of many tributaries of the Wye, Usk, and Towy, have only been partially re-opened, indeed, in some cases, a narrow passage only has been forced. For example, parts of Swansea, 200 feet above the river, stand on mounds of gravel which have not been removed since the icesheet melted.

In a previous paper (C.N.S. Trans., vol. xxxii.) I have shown that most of the mountain pools are due to valleys being partially blocked by glacial drift.

Of another type are the small "oxbow" lakes in the broader valleys, due to the streams deserting some of their curves. Such are common near the Towy above Caermarthen and along the Wye (Plate VII., Figs. 7 & 8).

Again, near the north outcrop of the coalfield, many small pools and bogs are situated on the surface of impervious strata, and are due to arrested drainage.

X. RELATION OF GEOLOGICAL STRUCTURE TO PHYSICAL FEATURES.

The Principality is in reality a great upland plateau, deeply trenched in every direction by the leading streams and their tributaries. The Snowdonian Ranges are separated by the Dee and the Severn from the monotonous elevations of the central shires, and these are cut off from the ridges of the south by the valleys of the Wye and the Usk. (Plate IX.)

I have already shown that the great valleys follow the lines along which are the outcrops of the softer strata. But each rock presents features somewhat peculiar.

"The Old Red Sandstone," says Baddeley, speaking of the Beacons Ranges, "assumes a square topped and somewhat artificial appearance in its summits northwards, while southwards it sinks gradually in bare featureless slopes."

The Pennant Rock, largely responsible for the high lands of the coalfield, presents unbroken lines of terraced hills which range for long distances, and many resistant layers of sandstone stand out in cliffs of varying height around the spurs of the hills. The features of the valleys are very similar, being produced by the same forces from the same rocks.

The surface of the Millstone Grit, where it occurs in force as north of the Amman Valley, is strewn with large boulders forming heaps and irregular masses.

While the Carboniferous Limestone never attains the development of the rock in Derbyshire, yet in Gower and South Pembrokeshire characteristic dales are to be found, bounded on either side by steep, and occasionally, vertical cliffs, as typical of the rock as its cold grey tone and stern massiveness.

The land mass has been long subjected to the action of various denuding agents, and most of its features show a close connection with the relative hardness of the rocks.

Thus, in a walk from Cardiff to Caerphilly, an observer will note the flatter ground on the outcrop of the new red beds, and

the rise at Thornhill, due to the harder conglomerates of the Old Red Sandstone.

The depression by the Thornhill quarry and the brook course towards the Rhymney Railway tunnel, marks the outcrop of the shales dividing the upper and lower Carboniferous Limestone, and the crest of the ridge beyond corresponds with the outcrop of the Millstone Grit. The ridge between this point and Caerphilly occupies the position of the outcrop of the middle Coal Measure sandstones—the same rock which stands out boldly in Garth Hill north of Walnut Tree.

The leading features in Pembrokeshire largely arose from the presence of igneous rocks. The Precelley Hills running approximately east and west, and the Llanlawr Range close to Fishguard, occur where exposures of ancient lava-flows are found along with igneous masses, which have been pushed up from below into the slates and volcanic rocks at a much later period.

The road from Haverfordwest to St. David's is famous for its hills, the more important being those of Keeston, Roche, Brawdy, and St. Elvis, all due to the presence of bands of hard igneous rock intruded into or interbanded with softer slates and sandstone.

The features due to the character and position of the rocks are sometimes obscured by glacial drift and by the erosion of the ice itself producing rounding and hummocky appearances. The "roche moutonnée" aspect of the hills near the Upper Neath and Tawe was referred to by Professor Edgeworth David, and a figure of Gwaencefn-y-gareg was given in his paper.

Landslips are not infrequent, and produce the characteristic undercliffs along what would otherwise be steep cliffs and escarpments. Such, for example, are observable on the south shoulder of Hatteral Hill, and on the face of Skyrrid Fawr near Abergavenny.

Near Hereford, landslips have occurred at various periods, at least since A.D. 1575, and apparently were due to the jointed structure of the Silurian rocks, the steepness of dip, and the percolation of much rain down the joints.

44 *The Origin of the Physical Features of South Wales.*

It is held by some geologists, that faults are primarily responsible for the occurrence of many long and low cliffs. Within the area of the coalfield, where faults often form the boundaries to royalties, movement along the faults has taken place during modern times in consequence of the winning of coal. An example, which occurred suddenly, was described to the Society by Mr. T. Evens, and his paper is to be found in the C.N.S. Trans., vol. xxiv., part 11.

Where a hard bed crowns a hill with long slopes, joints may give rise to a peculiar feature.

The Buckstone near Monmouth—a famous rocking-stone—is a detached mass of Old Red Sandstone. Other large masses of similar type have also been separated through the atmospheric degradation of the marls below the conglomerate, and have, in consequence, rolled down the slopes over which they now are strewn. (Plate I., Fig. 4.)

XI.—COAST OUTLINE; ITS ORIGIN AND PRINCIPAL FEATURES.

It is difficult to say what the outlines of Great Britain were like before the Glacial Period, though some indications of the coastline remain with us in the caves of Gower, which, though now high up above sea level, are clearly due as to their origin to the action of the tide (Plate VII., Fig. 12). The old beach lines of those times can also be seen at various points near the caves and along the coast of Pembrokeshire.

We know that during the Glacial Period the land was much depressed, though not to such a degree as to bring about a general submergence. Again, evidence is forthcoming to prove that after most of the glaciers had disappeared from the mountains, an upward movement took place, which assisted the revived streams to channel their way through the drift filling their valleys, and in some cases to entirely remove it.

England as a whole stood higher out of the sea than it does now, and the seas around were broad river valleys. The Thames and the Rhine united to flow northwards along

PLATE IX.



MYNYDD TROED,
AS SEEN FROM LLANGORSE LAKE, LOOKING NORTH.

THE VIEW SHOWS THE ESCARPMENT OF THE UPPER OLD RED SANDSTONE AND ITS
DIP SLOPE ON THE RIGHT.

Photograph taken by P. Morton, Esq., M.A., of Christ College, Brecon.



CAVE ON MELLTE RIVER,

$\frac{2}{3}$ -MILE BELOW YSTRAD-FELLTE, SHOWING INLET TO UNDERGROUND WATERCOURSE
EXCAVATED ALONG THE BEDDING OF THE CARBONIFEROUS LIMESTONE.



MIDDLE CLYNGWYN FALLS,

ON THE MELLTE RIVER, DUE TO FAULTING OF SHALES AGAINST GRIT.

Photographed by Miss Neale.

Digitized by Google

the present North Sea; the hollow of the English Channel formed the combined valley of the Seine and Somme; Bristol Channel was evidently a continuation of the Severn, and a large stream flowed southwards through the Irish Sea depression. (Plate VII., Fig. 10.)

During this period of elevation the large Continental mammalia crossed into Britain accompanied by Primeval Man. Data respecting the length of the period are not forthcoming. We know, however, that Man had advanced far towards civilization, and a new race had settled here at least before the sinking of the land had ceased. The evidence on this point is conclusive.

Along both shores of the Bristol Channel, beds of peat composed of land and freshwater plants are buried beneath marine deposit, and imply a subsidence of about 60 feet. The evidences as to this subsidence in recent times was set out in a paper (C.N.S. Trans., vol. xxviii., part 2, Geology of the East Barry Dock).

The rare finds, indicative of Roman occupation near the coast, occur in the marine deposits above the peat series; hence it has been asserted that Britain has become an island since man first settled here; and secondly, that subsidence ceased and the coastline assumed approximately its present position before the Roman Conquest took place.

The subsidence would cause the flooding of the lower portions of the broad river valleys, which would become long gulfs, while smaller streams would pass into fyords, or using the Pembrokeshire word, *pillls*, and in some instances, where two streams ran in opposite directions, straits would result.

The sea encroached steadily along the old Severn stream, and the whole valley was submerged, as well as the low ridges separating the tributary streams from the main river, except the peaks which remain as islets, such as Flat Holm and Steep Holm. The bays on either side of the Bristol Channel mark the old valleys of the leading tributaries. Swansea Bay occupies the lower reaches of the Tawe and Neath Rivers, and

Caermarthen Bay, the trunk of the now separated Towy and Tâf. Goodrich Bay is the flooded portion of the Gwaen, and Newport Bay of the Nevern. Even the small stream of Stackpole became a narrow arm of the sea, which has become converted into a lake by accumulations of sand.

Had the subsidence never taken place, Nelson could not have eulogised the roadstead of Milford Haven, nor would Shakespeare have made Imogen in *Cymbeline* ask—"Tell me how Wales was made so happy as to inherit such a haven?" It is plainly the sunken portion of the *Dau Cleddau* and its tributaries.

The streams did not merely cease to deepen their channels: they were depressed so much below the general level of the present sea bottom that the river-beds are buried beneath a thick mass of silt. Those of South Wales are sometimes 50 feet below the level of low water spring tides, and are often filled with mud and silt to an equal depth. Other valleys escaped conversion into bays and gulfs by the amount of glacial material remaining, which the streams had failed to remove before the subsidence. Thus the gravel at Swansea is at least 280 feet thick, and extends downwards at one point to a depth of 150 feet below the sea.

When once a river-valley became an arm of the sea the method of enlargement was quite changed. The downward cutting gave place to horizontal denudation, and the constant movement of the sea found out every point of weakness. Almost every island in the Bristol Channel and every promontory of note along the South Wales coast is due to the presence of one especially hard rock—the Carboniferous Limestone. The Vale of Glamorgan, the Gower promontory below Swansea, and the South Pembrokeshire extension, all owe their preservation to this rock, and it is the weathering of this rock which produces features of special attraction to the lover of coastal scenery.

Sully and Barry Islands are isolated masses of limestone, which have been cut off by combined sea and stream action on

softer Lias limestone and shales on the northern side, and Caldy Island has been separated from the Tenby Cliffs by weathering along the grits and shales of the Millstone Grit.

The uninteresting character of the cliffs of South Glamorgan is largely due to the alternation of hard and soft layers of the Lias rocks and their excellent jointing and horizontal bedding. They rest, however, on Carboniferous Limestone, which appears in several places above high water mark, and for a long distance seems to be within the range of tidal erosion.

Oxwich Bay in Gower indicates the position of a fold, which has squeezed a small patch of Coal Measures between the Carboniferous Limestone of Pwlldu and Oxwich Point, while Rhôssili Bay is equally due to an upfold bringing up Old Red Sandstone between Worms Head and Burry Holmes. Saundersfoot Haven, between the limestone of Pendine on the north and the Tenby mass on the south, is due to the same cause as Oxwich Bay. Lydslip Haven occupies a hollow in Millstone Grit, which is folded in between the limestone of Penally and Old Castle Head. Freshwater Bay, East and West, have been eaten out along bands of Silurian shales and soft Old Red Sandstone, exposed between the limestone ridge on which Pembroke stands and the great mass of South Pembrokeshire. (Plate VII., Fig. 9.)

The denuding work of the sea is helped sometimes by well-developed planes of bedding such as occur in Worms Head and in the cliffs of Marloes Sands, west of St. Ann's Head, of which a photograph was reproduced in the last issue of the Transactions. Again, it is assisted by the vertical joints, as is well illustrated by the Tenby Stacks, and occasionally by a combination of both, as in the Lias limestone of South Glamorgan. Along such lines the sea forces its way, and by enlarging the opening, produces caves like the Tresillian Cave of St. Donat's and Martin's Cave, Tenby; or by undermining the cliff causes it to collapse, while in other cases it entirely cuts away portions from the mainland.

In the West of Pembrokeshire, soft sandstones and shales are penetrated by rocks of igneous origin, which offer much greater resistance to the sea. St. Bride's Bay lies between the promontories of St. David's and Marloes, occupying the area of a former extension of the coalfield, while the two horns are largely composed of igneous rocks. The channels between the islands of these parts—for example, Skomer and Ramsey—have been formed almost invariably along the bands of sedimentary character, and wherever small bays and inlets occur on the islands or on the mainland, the presence of such rocks may usually be inferred. All the islands except Skokholm; even the distant islets of the Bishop and Clerks, Grassholm, and the Smalls, are composed of rocks of igneous origin. (Plate VII., Fig. 11.)

Another feature characterising certain parts of the coast is the accumulation of sand in hillocks and dunes. These occur near Port Talbot, on the east side of Swansea Bay, and near Llanelly and Ferryside, on the north-east side of Caermarthen Bay, and on a smaller scale on the east side of the bay on Barry Island, and again at Newgale Sands to the N.E. of St. Bride's Bay.

The sand and mud brought down by the rivers entering these bays are separated by the tidal currents. The mud being lightest is carried away furthest; the sand being dropped near the shore is laid bare at low tide, and under favourable conditions is blown inland by the prevailing south-west winds. Hence the sand dunes occur principally on the windward sides of the bays. The alluvial mud forms wide flats at certain points, and where they have been subsequently cut off from the sea, as at Aberavon by sand drifts, the land has actually encroached upon the sea.

Near rocky portions of the coast, currents sometimes sweep along boulders and pebbles, which become rounded and smaller in size by constant attrition. Under the influence of strong winds the pebbles are thrown up and form long banks. Such is the origin of the pebble ridge between Barry, Cold Knap Point, and Porthkerry.

XII.—CONCLUSION.

It is obvious, therefore, that the rivers of South Wales do not date back further than the Neozoic Epoch, and that their drainage systems were not fully developed until much later. On the contrary it is equally clear that they had reached maturity before the great Ice Age, and that many minor features, produced by the streams before that period, are still masked by the glacial drift.

The same deposits gave rise to many of our lakes and tarns, which, therefore, are of comparatively modern date, while the coastal scenery has been principally produced since Britain was first inhabited by man.

XIII.—INFLUENCE OF PHYSIOGRAPHY ON MAN.

It is unnecessary here to point out the connections between the transverse valleys and the winning of the coal seams, and the resulting prosperity of South Wales. The influence of the anticlinal folds in bringing within workable limit valuable coal is equally well known.

But it is not so obvious that the smaller tributaries of the big rivers are responsible for the flatter expanses of ground, on which the villages of the coalfield are placed. The gravels brought down by these streams are spread out in radial fashion near their confluences with the major streams, and at these points villages have been developed. Two examples will suffice. Resolven stands on the fan of a brook which joins the Neath, and Talybont on the fan of the Collwng where it joins the Usk.

Again, as the silting up of the lower reaches of the rivers proceeded rapidly after the period of depression, the Romans found it necessary to remove from Caerleon to Newport for a harbour, and the docks along the south coast of Wales have been constructed with comparative ease in the softer deposits associated with the peat, and in the silt which has been laid down since the subsidence came to an end.

We are now more or less independent of the natural features, though river terraces, representing former levels of stream action, are taken advantage of in the development of new residential centres. The growth of Bridgend, Neath and other towns, not excepting Cardiff itself, have been much influenced by the presence of gravels belonging to the old terraces of the rivers.

In the old times every feature of importance was seized upon, and the influence of nature is readily traceable upon the lives and habits of the people.

Brecon has developed from a prominent Roman Fort—y Gaer—situated on a hill of Old Red Sandstone rising out of the hollow of the Usk Valley, the preservation of which is due to a hard mass of concretionary limestone. The fort was no doubt established to keep in check the natives, who had converted into strongholds neighbouring hills, which owe their origin to exactly the same cause. In more peaceable times the town moved from the hill to the valley, and grew at the one favourable spot where the Tarell and the Honddû had developed wide fans of gravel suitable for the purpose.

The history of Caermarthen is very similar. Many strongholds had been established by petty chiefs on the prominent spurs of the valley left by the stream in its meandering course. As the country became more settled these were of less importance, and a great town sprang up where the three rivers joined their waters and their fans with the tide and its muddy deposits.

Castell Cerrig Cennen, near Llandilo, was placed on an isolated rock rising precipitously for 300 feet above the valley of the Cennen. The rock is a mass of limestone separated from the main outcrop by a fold, which has brought in a band of shales easily denuded into a rock hollow along which the stream flows. Pembroke and Carew Castles again are erected at points where folding and faulting have brought soft Old Red Sandstone against Carboniferous Limestone, and denudation has eaten out the soft sandstones, leaving ridges of the

harder rock. Benton Castle, North of Milford, caps a cliff overlooking the Cleddau at a point where igneous rocks are brought up between Old Red Sandstone. Llanstephan Castle near the mouth of the Towy, and Ewyas Harold Castle near Abergavenny, are both situated on masses of limestone standing out above the surrounding red sandstones. Castell Arnold, below Abergavenny, was erected on a mound of glacial drift rising above the general level of the Usk Valley.

Even the architecture of past centuries was influenced by the geology of the district, for it rarely happened that the stone was brought from long distances. The soft limestones of Sutton lent themselves better to the delicate tracery of Neath and Swansea than the Old Red Sandstone of Llanthony and Tintern Abbeys.

LITERATURE.

- | | | |
|-----------------|-----|--|
| Sir A. Ramsay | ... | Physical Geology and Geography of Great Britain. |
| Sir A. Geikie | ... | Scenery of Scotland. |
| J. Phillips | ... | Geology of the Thames Valley. |
| Do. | ... | Geology of Yorkshire. |
| J. E. Marr | ... | Origin of Scenery. |
| W. N. Davies | ... | Physical Geography. |
| H. R. Mill | ... | Lakeland. |
| Lord Avebury | ... | Scenery of Great Britain. |
| H. N. Mackinder | ... | Britain and the British Seas. |
| A. Strahan | ... | Origin of the River System of South Wales. |

Memoirs of the Geological Survey.

I am indebted to Messrs. Macmillan for allowing me the use of their blocks in Plates III., IV. and V., and also to Professor W. W. Watts (from whom at school and college I learned much) for whose book, "Geology for Beginners," the blocks were originally prepared.

I must also acknowledge the kindness of the owners of the copyrights, in so freely consenting to the reproduction of their photographs.

SOME FOLK-LORE OF SOUTH WALES.

By T. H. THOMAS.

The notes following represent a portion of a Lecture, illustrated by slides of the localities mentioned and objects connected with the folk-lore. It will be perceived, on perusal, that vast regions of such lore are untouched on account of limited space. The Serpent, the Eagle, the Raven, and their qualities, weird or healing, are not mentioned, nor have we touched the Fairy-lore, offering a wide field, which, however, has been considerably worked, especially by the late Hon. Wirt Sikes, in his "British Goblins," a work in which the writer, to some extent, collaborated. Nor is any mention made herein of a class of stories of high interest and as yet unworked, namely, the adaptation of the old existing tales to the conditions of modern life in a greatly extending mining district. Tales of elf, goblin, ghost find an apt development in the coal-pit, with its darkness and risk to life and limb, and a chapter might well be written upon the strange way in which olden stories re-appear, "brought up to date," and adapted to their surroundings. Nor have old customs, such as Morris Dancers, the Mari-lwyd, and the Rhodd Calenig, or New Year's Gift, been treated.

ARTHURIAN LEGENDS.

As South Wales is so definitely the land of King Arthur it may justly be expected that in the folk-lore of the country we should find him represented. Accordingly we have three spots, each of marked character, which have stories connecting them with the great King of Romance; "King Arthur's Round Table" at Caerleon, probably simply a pseudo-historical attribution unconnected with the underlying mythological

meaning of the Pendragon and Arthurian Tales, but based only upon the romances of Geoffrey of Monmouth. Craig-y-Ddinas in the Vale of Neath (Illustration IV.) and the Maen Ceti, or "Arthur's Stone" in Gower; the two last being seemingly legends of the older times. But these are by no means the only tales told of King Arthur, many a crag or castle has the tale of Craig-y-Ddinas told of it, either Arthur himself, or a King, resides with his warriors under the hills of the north of the county, under Castell Coch at Taff's Well, under Morlais Castle, &c., &c., and the Maen Ceti is not the only stone upon which he has tried his sword, as the same tale has been told us of the still greater Cromlech at Duffryn Golwch, and some other stones. These we consider to be only adaptations, imitations by local romancers. In the case of the imprisoned King there is always the attendant tale, with many variants, of the boy, man, half-witted person, robber, or other character who breaks in upon the sleeping warriors, escaping with his life only through the drowsiness of the heroes whom he disturbs. It is a curious thing that in these stories, neither through intention or accident has a woman ever broken in upon their slumbers.

Too much reliance upon King Arthur's connection in story with the vast Cromlech on Cefn Bryn in Gower may not be wise, considering that any great erection may naturally be considered to have heroic and gigantic architects or attendants, so that great Cromlechs are called Coetan Gawr, Coetan Samson, Coetan Arthur, indiscriminately, yet there may be more than this in the King's collocation with the Maen Ceti, if we may suppose that the latter name does hide a connection with Ceridwen, the nature goddess of the Mabinogion, and that the almost universal name of Gwal-y-filast (kennel of the bitch-hound) for our Cromlechs may indicate one of that deity's metamorphoses.

Another Arthurian identification we feel inclined to make, that is, that the appalling spectre-hound which ranges the whole of our region, and which we speak of elsewhere, who is

known as *Ci-bal* may be in fact Arthur's great hound 'Cabal' who led the hunting of the *Twrch-trwyth* described in the *Mabinogion*.

RUDE STONE MONUMENTS AND TUMULI.

In regard to cromlechau and meini-hirion there is a considerable mass of legend having some singular characteristics. All the South Wales counties are very rich in these remains, and among them are monuments of extraordinary size. We may refer to the two great cromlechau at Duffryn Golwch the larger of which is perhaps the largest in Britain, the celebrated Arthur's stone in Gower, those of Long House and Pentre Ifan in Pembrokeshire. Among meini-hirion are such examples as the *Maen Llia* beyond *Ystradfellte*; an enormous, but hardly noticed one near *Margam*; the *Maenhir* of *Rhos-clegyr*, near *Goodwick*, *Pem.*, with many others. These are all uninscribed. Inscribed stones are numerous, without counting monuments of the seventh to the tenth centuries.

Nearly all the cromlechs and many of the maenhirs have the local name of *Gwal-y-filast*, or more rarely *Carreg-y-filast*, the former indeed appears to be the ordinary name for such erections, we believe that "cromlech" is merely a literary applied name in South Wales, for the most part old people of the peasant class do not understand the word. *Gwal-y-filast* means *Lair of the Bitch-hound*, the term is invariably feminine, occasionally there is the variant *Gwal-y-bleiddiaist*, *Lair of the She-wolf*, with still another "*Cist y Gest*," which may be "cest" a rounded receptacle, or a corruption of "gast." Other local names are *Coetan-Arthur*, *Coetan gawr*, *Coetan Samson*, meaning *Arthur's*, etc., quoit. In legend, cromlechs are the playthings of these titans.

The she-wolf or dog names deserve study. It is true that they may have arisen simply from the house-like character of the remains. On the other hand the constant feminine differentiation, together with attached legends, make us suspect some connection with the metamorphoses of the hag *Ceridwen*

as told in the Mabinogi of Taliesin, the more if the "Maen Ceti" or "Cêd" of Gower can be connected therewith.

Upon the hill at Rumney, near Cardiff, existed till recently a Gwal-y-filast which was a cromlech near the village, and the name is still applied to the maenhir further along the hill at the house now called "Druidstone." When we consider that the name written Rumney or "Rompney" is universally pronounced by the people "Rummi," we are tempted to ask the question whether here we are at the Lair of the Gast Rhymi of the Mabinogi.

In connection with several cromlechau are tales of a metamorphosis into a horse. Of one, the Maen Ceti, it is said that on a certain night or nights of the year, it goes down to Port Eynon a few miles away, to drink of the sea, and there are dim traces of a dread female Presence which rides it. Of the great Duffryn cromlech it is said that a saddled horse has been seen standing by and that venturesome souls have mounted it, and been carried madly around the country yet found themselves in the morning lying upon the great cover-stone of the cromlech. Dim echoes, too, of magical rites, are found in relation to both types of monument, and we think there is evidence to show that such rites are still carried on half in jest and half in earnest. Tales, too, are told of gold and treasure guarded in them by spirits or ravens or serpents.

But wraiths of human guardians, or inhabitants, are rare about cromlechs, while they are remarkably numerous about tumuli. This seems curious, as nearly all cromlechs originally presented the appearance of tumuli. It would seem that the denudation of the monuments caused a new set of stories to be invented. The story told as to the Great Tumulus at Mold, where the golden corslet, or other armour, was discovered, and which may be read in Prof. Boyd Dawkins' "Cave Hunting," is paralleled in many cases. Once in regard to a tumulus near Stormy Down, Glamorgan, where a similar tale existed of a warrior with golden ornaments, and where a veritable and weighty golden torque was exhumed. A similar story is

told of the tumulus and maenhir some miles north of Gelligaer, where a "soldier, as it were, covered with medals," has been seen crossing the path of a traveller, and disappearing into the ancient sepulchre. It has been observed, in regard to such stories, that they may have been handed down even from the bronze age. That time may be bridged in such a way seems less unlikely when we consider that a line of twenty-five nonagenarians might preserve tales older than our era.

WELL AND WATER LEGENDS.

Ideas as to the curative properties of wells are very common in the district. The number of recognised wishing wells is considerable, and to "wish" at a well is common even when no legend or character attaches to the fountain. For our purpose the use of wells from which medicinal waters flow is unnecessary, and they will be ignored. As far as the writer is aware, the recognised "Wishing Wells" and "Rag Wells" produce simply pure liquid. Upon the Skirrid Vawr Mountain, near Abergavenny, a well, or rather an ooze, exists which has special sanctity, as it is near a remarkable landslip which is said to have occurred at the time of the Crucifixion, when also the water gushed forth. This well is still visited, and the water drunk or carried away as having medicinal or holy qualities. In Monmouthshire wishing wells are rather numerous, and one called Ffynnon Angoeron—Well Verycold—may be cited. (Illustration I.) It is situated on the flank of the Lasgarn Mountain, above Llanover, and its bed is generally full of bent pins, buttons, and other small objects which have touched the person of the wisher. In all cases the wish must be silent; the spell is broken if it be spoken. At Llanover, within the demesne of the Hon. Mrs. Herbert, is the Ffynnon Over—Govor's Well. This is an outflow of pure water which gushes from seven springs, each of which has its separate well, and the group embowered in woodland is most picturesque. The well at Patrishow, above the Grwyny River, north of the "Sugar Loaf," or "Penyfal," near Abergavenny, seems to

have lost its ancient esteem, but has built in its sides niches for offerings. Among the many wells in Monmouthshire and borders visited we have met with no instance of a true "Rag Well," though, beside *medicinal* wells, rags may be left accidentally.

For the true "Rag Well" we must visit Glamorgan and Carmarthenshire, where they are numerous and still resorted to. In the neighbourhood of Cardiff there is the celebrated Wishing Well of Penylan, now enclosed in the grounds of Sir Alfred Thomas, M.P. (Illustration II.) This was formerly a Rag Well, but has long been disused. As a Wishing Well it was until recently very popular, and within forty years a sort of fair was held by it at Easter, and folk "wished" by hundreds. A saint's well now enclosed in Roath Park, and also St. Teilo's Well at Llandaff, have now lost all observance. In the park at Coed-rhyd-y-glyn, the seat of Capt. Treharne, exists a small circular well which is considerably visited as medicinal, and rags from the clothing, or especially from bandages of the votaries, are continually suspended from the branches of an oak tree which overshadows it. (Illustration III.) Near Coity also there is a Rag Well much valued and visited. Near Llanccarfan are two wells of holy repute. One seems to have been dedicated to the saint; the other, which is largely used and much decorated with rags, is called "Ffynnon flamwyddan"—"Flame Well" literally, but meaning "St. Anthony's Fire Well." Beside this well we have counted seventy-five comparatively recent *ex voto* offerings of rags tied to the bushes around, besides the scores of remains of others. Spite of its popularity, this well is not an excavated or built well, but simply a gush of water amidst soft ground. Further down the "Bro Morganwg," at Marcross, another celebrated Rag Well exists. We are informed many others of less note exist, as the Ffynnon Caradog near Llanilid.

Carmarthenshire has many examples, of which the Well of St. Anthony at Llanstephan is an example, where, however, only "wishing" is now practised.

In connection with wells, a game is popular in many parts—Aberystwyth; Glamorgan: A child stands in a corner of the room behind a chair or other guard, and covers her head with a cloth. To her, her playmates advance. One says, "Get water from the well." "No," is replied, "I fear the Ladi Witch yn y ffynnon." Then they advance cautiously, one presenting a lighted candle; the "Ladi Witch" in the corner discloses herself and blows the candle out; all disperse with shrieks. Probably here is a witches' well and a holy candle.

Water legends take chiefly two forms: first, the inability of evil influences to cross running water, as witches, sprites, demon dogs and other unholy embodiments; and, secondly, dim impressions as to magic efts, water snakes and fish. Also the often reiterated tale of fairy denizens of lakes and pools.

The only well-defined transformation story we have gathered in regard to fish and water was obtained near Carmarthen, but does not seem well known. It deserves publication: it was recited by our informant with great clearness and, indeed, dramatic force, and nearly in the following words:—

"Upon the Towy floated a fisher lad. He was in the very dew of his youth. He sat in a coracle with his paddle stuck under his left arm pit, with his salmon rod and his "Knocker," to kill his fish, all ready. Suddenly a great salmon leapt to his fly, and there was a long fight, in which at last he got the better, and the big fish was flapping in the coracle between his feet with the hook through its upper jaw on the left. He took his club and said "Now, I will knock thee." When the fish reared itself against his leg, and spoke with a faint human voice, as it were the voice of a babe, and said, "No, do not knock me, be my 'cariad' (lover), and I will be thine." "No," said he, trembling with amazement, "thou art a devil, and I will knock thee," raising his arm to strike. But before the blow could fall he found himself in the arms of a beautiful girl, but cold and wet, who knelt between his feet, but her face was against his and her eyes were asking him and she said "Be my 'cariad'." "No," said he, "thou art a devil, I will knock thee."

"Then I will drown thee," said she, bending him over with all her strength; so they capsized. Then the girl plunged him deep in the river and brought him up sputtering, for he could not swim. "Wilt thou be my 'cariad'?" said she. "No," said he, "thou art a d —." "Then down you go yn ngwaelod yr avon," said she, and down they went. Up again she brought him, panting. "Wilt thou be my 'cariad'?" said she. "No," he said, "by . . ."—the word was drowned in his mouth. She forced him down again into the weeds at the bottom. Then she plucked him up again, "Now, wilt thou be my 'cariad'?" The lad was almost drowned, and said "Yea." At that she was delighted, and wrung him in her arms, and swam with him with her feet to the shore. And the coracle went down the stream and the rod too, but that was held to her by the hook and line, for the hook was in her upper lip. So when he came to his strength he had with him a gel without a stitch of clothes on her. Oh, a beautiful gel as white as a salmon, trying to get a hook out of her lip. So he says, "Pity, I will get it out," but he could not pull it through. "I must cut thee," he said, and took out his little knife. "Yea" said she, "Cut me," and he cut the hook out carefully and she did not wince, but kissed him suddenly on the mouth, so that her blood was upon his face. "Now thou hast taken of my blood thou wilt love me for ever," she said, and at the word there came a violent love for her which never left him during his whole life. He took her home and lived with her a long and lucky life, having many children who all had a little scar, or what seemed like one, in their upper lips, to the left."

But our informant said that if when the lad came up the second time he could have completed his oath with the name of the Almighty, she would have become 'Eog,' a salmon again.

HEALING BY DISSOLUTION OF OBJECTS WHICH HAVE
TOUCHED SORES, &c.,

Is common in all parts of Wales we are acquainted with. The commonest form it takes is, as elsewhere, in the cure of

warts or other excrescences. A piece of rag, string, &c., is applied to the wart and is then thrown over the left shoulder with, or without the utterance of a formula. The excrescence withers as the rag decays. The same idea underlies the exposure of rags at the wells, and in another form exists in the belief that if a portion of clothing or a personal relic, as hair or nail clippings, from a sick person be flung into running water he will recover. Traces of these beliefs are easily discovered, the latter form usually in places near the sea along the whole of South Wales. In another form the illness may be attracted from the sick by contact with some object to which such power is attributed. We have known pumice and especially the bone of the cuttle-fish to be used thus, and for small local inflammations, and especially for cataract the "maen magl" or "web-stone" which is usually the bead further mentioned when noticing snake-lore, is considered "virtuous."

Of the belief in cure by passing on disease to others by means of objects which have been in contact with the sick, a belief often hideously exemplified in the South of Europe, and which may be distinguished in Cornwall, Devon and Somerset, we have, personally, found no trace in Wales.

APPEARANCES OF MALEVOLENT SPIRITS.

Such appearances are frequently recounted. They take two forms, one, in which the Goblin assumes beautiful aspect, having sexual allurements; the other, in which the demon takes hideous form, but by its actions tempts wayfarers into dangerous places and abysses. Of the first, a tale told us in childhood may stand as a type. It is of the neighbourhood of Pontypool, Mon.

The lover of Mary Watts passed along the Miller's Road to a tryst. This road passes beside a river; one side precipices covered with forest trees rise; across the river begin the outskirts of the town and iron-works. The wayfarer heard steps behind him, and a young maid, with a shawl over her head, slipped up beside him, and glancing at him with her dark eyes

PLATE I.



"FFYNNON ANGOERON."
A "WISHING WELL" NEAR MAMHILAD, MON.

PLATE II.



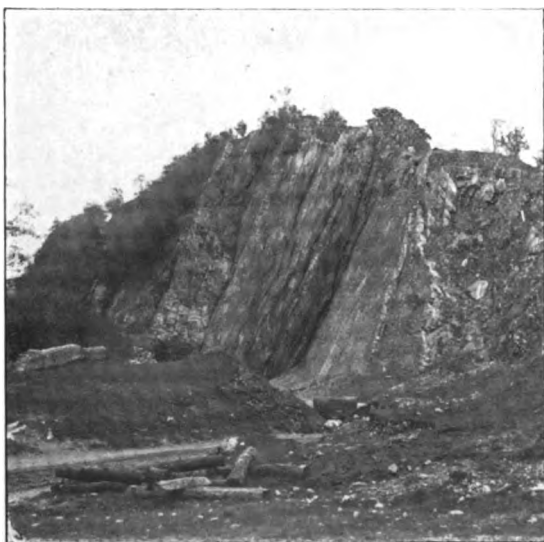
"RAG WELL," COEDRHIDYGLYN, NEAR CARDIFF.

PLATE III.



**"WISHING WELL," PENYLAN,
NEAR CARDIFF.**

PLATE IV.



CRAIG-Y-DDINAS, VALE OF NEATH.

bade him, in a soft voice, "Good evening." He responded kindly, for he thought she was the daughter of Rowlands, the Hammerman. "O, Bob," says she, "I'm jest going into town to look at the shows in the Blue Boar Field. Come you with me; there is a dance in the 'Forge Hammer' Room; I will dance with you all the evenin'." Bob declined, but the maid pressed him, even going at last to the extreme of winding her arms round him, and dragging him with extraordinary strength towards a short cut to the town. Feeling himself overpowered, Bob tore the veil from the girl's head, crying as he did so, "By God, I will not come." At the sacred oath the beautiful face sustained a change, became first beautiful, and then repulsively appalling; an aureole of blue flame surrounded the slender figure which sunk into it "like iron in the furnace," till, writhing, it was seen no more, and there was only left a spiral azure flame winding down to a very gradual extinction.

Of the second form of appearance the "Old Woman of the Mountain," and the malevolent "Pwcca" (Puck)—both well described by Wirt Sikes—are typical. They are appearances which mislead travellers in desert places, both on mountain and plain.

SATANIC APPEARANCES.

These are very common and in vast variety, and generally open by casual meetings upon roads in the gloaming or night, the passenger is maltreated, in some cases even killed, but most frequently the ill-treatment includes levitation either by the arms of Satan or sometimes by propulsion *a tergo* by the hoof, as where a too jovial clergyman of the eighteenth century was propelled thus from one valley into a pool in the next without greater injury than a miserable submersion.

A good many tales of Satanic appearance and influence are connected with churches or holy places and dimly commemorate probably struggles between the early Christian missionaries and the earlier paganism. The tale of the founding of St. Cadoc's

Church at Trevethin in Monmouthshire is typical. Upon the Lasgarn mountain between Trevethin and Blaenavon an edge of sandstone strata forms a kind of tor, some masses being "pitched" vertically, this is known as "Garn Clochdy," bell tower cairn.

When St. Cadoc was engaged in building the church Satan opposed him, and battered down at night the saint's work by day. The saint determined to baffle him by casting a holy bell, the strokes of which should paralyse the enemy. At a time when Satan had filled his apron with rocks to complete the destruction of the church, Cadoc had succeeded in swinging his bell, and its notes reaching the enemy as he strode over the mountains caused him to drop his missiles in a heap, while he fled howling with pain and rage.

In connection with this struggle between the old and new cultus, or between good and evil, many stories also as to the building of bridges occur. The building of a bridge was only second to the building of a church, this is well illustrated by an ancient bardic story and aphorism, "If he be a Bard, let him be a Bridge." In result these bridge stories are variants of the almost universal incident of a struggle between the builder and the spirit of evil, or, or with, a bargain on the part of Satan for the first living creature that passes over, in which the evil one is over-reached by the saint. This subject has been treated at large by the Rev. Baring Gould and others, who show in it survival of human sacrifice.

Tales occur of Satanic possession of deserted churches, of monstrous sacrilege. These are of great interest to the student, but unsuitable for publication.

WANDERING AND HUNTING DEMONS.

These include, besides such spirits as the "Old Woman of the Mountain," others, such as the Cyhirraeth, agonised souls who fly as birds, screaming as they touch one another, over the mountain wastes on dark nights; the "Cwn Annwn," or Hell Hounds, who bay in sky or moor as they rush after prey; but

the most interesting of hunting demons is Ci-bal, a hound of enormous size, mephitic odour and mighty voice, who ranges the whole district, hunting belated wayfarers, whose only chance of safety is to cross running water. Ci-bal may be supposed to mean literally the out-rushing dog, from "bal," a Celtic root, implying thrusting up or out, as in Bala, Pen-y-fal, Bal-mawr, &c. ; but the identity of the name with that of the great hound of King Arthur may afford us a curious and interesting link between this awful apparition and the great King. We have notes of Ci-bal extending from near Builth (where, according to Nennius, his "Carn" stands, and where he has left the imprint of his foot upon a stone), to the limits of Pembrokeshire and Monmouthshire, while he ranges at large through Glamorgan and Carmarthenshire. What wider range similar spectres have may be observed in the novel of the "Hound of the Baskervilles," and he appeared, to the great moral benefit of the spectator, to the Rev. Samuel Drew, the distinguished divine and philosopher of Cornwall, as described in his memoirs. Most people have heard of Ci-bal, but we have met but one who has seen him. He would not describe him, but said, "If you had seen him you would not want to talk about him neither."

APPEARANCES OF SPIRITS SEEKING BURIAL OF THEIR BODIES.

Tales of this class are numerous, one from this immediate neighbourhood is typical. It was given me by the participator, who was walking from Canton to Leckwith at night, and was joined by a silent man who dogged his footsteps and gazed upon him imploringly. He would not be shaken off. "I called him names and threatened him. He only kept looking, looking at me, but said nothing. I got into a rage and said, 'N'en o Duw, what do you want'? Tears ran down his face and he said, 'I couldn't speak till you asked me in the name of God. I am dead but I cannot rest till my head is buried' (the bone he meant, what you call skull). 'I was boatman,' he said 'down the Ely river, and my head is on the bank and devils do play

football with it. If you will come and bury it I shall rest.' So I agreed to go in search of the skull and he took me down the river to a bend, just above the Taff Railway Bridge as is now, and there by a bluish light was a lot of people kicking football like hurrah with the poor man's skull. I thought I would go to them praying, and as I came to them they all flew away. So I took the poor man's head and buried it in a soft place, digging a hole with my knife, and the ghost he stood and looked at me, till he went out like smoke."

APPEARANCES OF SPIRITS SEEKING FORGIVENESS
OR RESTITUTION.

Tales of this nature are, as elsewhere, very numerous, and it would be useless to do more than note the fact, though many such tales are weird and picturesque in their incidents.

It may be thought by readers who have paid little or no attention to the collection of folk-lore that the enumeration of so many beliefs or quasi-beliefs of an occult character still existing, or but lately lost, in Wales, indicate that the peasantry of the country are superstitious in general. This is, however, by no means the case. When we compare Wales with the English Counties of Gloucester, Somerset and Devon in which we have only to a small extent collected folk-tales while in Wales we have collected largely, we consider Wales to be comparatively free from superstition. Nothing strikes the collector more forcibly than the fact that most Welshmen, while full of old-world tales, are free from superstitious belief in them, and are, more or less consciously archæologists and reciters. On this account tales of witchcraft as now occurring are curiously rare in comparison with (especially) the County of Devon, where they abound. It may be remembered that the Welsh have been for many centuries a race of reciters of tales and improvisatory poets, a character fixed in them by the wanderings of the old bardic orders, and our experience is that our beliefs in the occult have given way to our artistic appreciation of the stories, and we have often been amazed by the spirit and dramatic force with which the tales have been told.

MEMBER LORDSHIPS OF GLAMORGAN.

 BY J. S. CORBETT.

It will be known to all who have looked into the early history of this County that the district in mediæval times bearing the name of the County of Glamorgan was far more limited in area than the present County, which was constituted as it at present exists by the Statute 27 Hen. VIII., cap. 26.

In that statute the County of Glamorgan is treated as already existing, and it is enacted that certain lordships, &c., shall be united to it, and that the whole shall be known by the name and shire of Glamorgan.

Glamorgan (including in that expression what was known as the "body" or County proper as well as the "members") is described by Leland and others as extending from the River Rhymney to the Crymlyn Brook. Using modern terms, it might be described as including the district between the Rhymney and the Tawe with the exception of the parish of Llansamlet. This was the district which, after the conquest had been completed, owned the over-lordship of the Lords of Glamorgan. With Gower and the country to the west I am not at present concerned. It some time since occurred to me that now manors or lordships have long ceased to be of much practical importance, as what (to use a modern phrase) I may call administrative areas, and owing to many manorial privileges and customs having become obsolete, there was danger that the geographical bounds and extent of the ancient County and its member lordships might be forgotten, at all events in a great measure. This would be a misfortune, because there can be no doubt that a correct knowledge of these lordships would be a considerable help to the study of the history and archæology of the district. I have therefore, by the aid of surveys (for the most part of the 17th century), and other information, prepared the map which is now before you,

which shows so far as I have been able to ascertain them, the boundaries of the old "members" of the County, and of some of the other more important lordships. I have thought it might interest you, and also be of advantage in enabling others to correct any errors into which I may have fallen, if I brought before you some facts with regard to the old manors or lordships shown on this map and their history.

The names of the member lordships, always regarded as such, and the Lords of which, before they came into the hands of the Chief Lord, enjoyed exceptional privileges, are, in alphabetical order Avan, Coyty, Glynrhondda, Llanbleddian, Miscin, Neath citra and ultra, Ruthyn, Senghenydd supra and subtus, Talavan and Tir-y-iarll.

In addition to these there are named in the Statute of Henry VIII., Talygarn, Ogmere, Llantwit and Llandaff, as to each of which I propose to say a few words.

I do not wish here to deal with the general history of the conquest of Glamorgan, but I must just mention that it appears to me that those histories which say or imply that Fitz Hamon conquered the whole district from the Rhymney to the Tawe, and granted it out, as regards the vale, to his Norman followers, and as regards the hills and parts of the west to the sons of Jestyn, to hold of him and his successors, hardly give an accurate idea of what took place. I should imagine that the truer view is that, while the Normans soon established themselves in most of the vale, the portion of the county which remained under Welsh Chieftains so remained of necessity rather than by grant, and that these chiefs were for all practical purposes independent for a century-and-a-half after the invasion of Fitz Hamon.

I can see but little indication, if any, that they considered their position to be that of feudatories to a lord, and, I think, what I shall have to say, however incompletely and imperfectly, as to those of the member lordships which remained in Welsh hands, will tend to confirm the opinion which I have expressed above.

With regard to the boundaries of the various lordships, it has been necessary, for the most part, to follow surveys of the 17th century. There is no reason to think that the boundaries mentioned in these had undergone any change, as compared with those of earlier times, so far as the northern portions of the county are concerned ; but in the case of the southern parts of Senghenydd and Miscin, and the lordships of Llanbleddian, Ruthyn, and Talafan, the boundaries may well be, and in some instances almost certainly are, different in some degree from those of the early mediæval days.

In dealing with the member lordships, I think it will be most convenient to begin with Senghenydd, and work westward, taking first those which extend to the northern bounds of the county, and afterwards those lying more to the southward.

SENGHENYDD.

This is by far the largest of the old member lordships, and remained under Welsh Lords until 1266.

The status and extent of this district prior to the Norman conquest is a matter of some difficulty, and time hardly admits of discussing it at length here.

It does not appear to have formed part of either of the cantrevs of Morganwg, not, apparently, being included in either Penychen or Gwentloog.

Giraldus speaks of the Diocese of Llandaff as containing five cantrevs and a fourth part of a cantrev, namely Senghenydd. It thus seems to have occupied an anomalous position. It has been suggested as a possible solution of the difficulty, that at some period when Glamorgan and Gwent were under different kings, Senghenydd may have belonged to Gwent (and perhaps formed part of the cantrev of Gwentloog), and may have been severed politically without being united to any cantrev of Glamorgan. Though not referred to at all in the very early list of cantrevs contained in the *Liber Landavensis*, it is named (though not as a cantrev or part of one) in one of the later grants set forth in that book, and land which extended

to the sea (perhaps what is now known as Splott) is described as being in Senghenydd. This would make Senghenydd include Kibbor. The grant is of the time of Joseph, Bishop of Llandaff, 1,022 to 1,046.

Whatever it may have been deemed to include prior to the Norman conquest, there appears to be no reason to suppose that since that time its bounds have differed materially from those of the present day.

It may be described as containing the whole of the parishes of Merthyr Tydfil, Gelligaer, Llanfabon, and Eglwysilan, the Hamlet of Van, Rudry, the Glamorganshire part of Llanfedw or Michaelston-y-fedw, and nearly the whole of Whitchurch. In one or two places, and to a small extent (probably accounted for in part by changes in the course of the river) it extends beyond the Rhymney into Monmouthshire.

Senghenydd *supra* is the part north of the Caiach brook, Senghenydd *subtus*, south of that stream.

Such is the great lordship of Senghenydd, which, according to the often repeated legend of the conquest of Glamorgan, was given by Fitz Hamon to Einon ap Collwyn, the traitor of the story. This can only be regarded as at the most extremely uncertain. What cannot be doubted, however, is that some sixty years later the celebrated Welsh chieftain, Ifor Bach, was Lord of Senghenydd. Of him it is recorded by Giraldus (who speaks of the event as having happened in his own time), and in the Margam Annals, that he took prisoner in Cardiff Castle, William, Earl of Gloucester, his Countess, and their son, and compelled the Earl to restore some rights of which he had been deprived.

This event, according to the Annals of Margam, took place in 1158.

His descendants and successors as Lords of Senghenydd were:—

Griffith ap Ifor.

Rhys ap Griffith.

Griffith ap Rhys, the last Welsh Lord of Senghenydd.

About 1170¹ William Earl of Gloucester confirmed a grant to Margam which had been made by Griffin or Griffith, son of Ifor, for the purpose of founding a monastery.

This is an indication that the Earl claimed to be over-lord of the district and that the monks thought it well to obtain his confirmation, though it can hardly be supposed he had much, if any, real authority there.

Of Rhys, son of Griffith, I have been able to trace but little. It seems probable that he was the "Baron of South Wales," who, in 1245² was, with others, summoned to appear at Westminster to answer for various depredations.

In the Annals of Tewkesbury it is mentioned that in 1242, Howel ap Meredith (no doubt the Lord of Miscin who was soon after expelled), Rhys ap Griffith and Gilbert de Turbervill disturbed Senghenydd and Miscin by fighting with one another. Richard de Clare sent certain of his friends, including the Abbot of Tewkesbury, to inquire into the matter, and they, having assembled a Comitatus, or County Court, at Cardiff, pacified the disturbers as well as they could, and took hostages from them, the hostage for Rhys ap Griffith being his son (not here named) who was put into Cardiff Castle. It seems a little curious that the sending of these peacemakers is ascribed to Richard de Clare, for he did not come of age till 1243, the following year.

Of Griffith ap Rhys, the son of Rhys ap Griffith, perhaps the same who was a hostage in 1242, we learn from an extent of the County³ made on the death of Richard de Clare in 1262, that he held two commotes in Senghenydd owing no service except a heriot of a horse and arms at death. This was of course practical independence. Under date 1266⁴ in certain Welsh Annals, it is stated that Griffith ap Rhys was taken in Cardiff Castle and sent to Kilkenny to be imprisoned. After this we hear

[References to "Cartae" are to Mr. Clark's Volumes of Charters.]

(1) Cartae III., p. 102.

(2) Cartae I., p. 84.

(3) That is, probably so made. Certainly within a year or two of that date.

(4) Cartae III., p. 558.

no more of Welsh Lords of Senghenydd. I have not ascertained what was the special pretext for dispossessing Griffith, but think there can be no doubt that Gilbert de Clare, by whom it was done, was following up the policy begun by his father Richard, of getting the member Lordships into his own hands. In 1268 the building of Caerphilly Castle was begun by de Clare, and this led to a long controversy between him and Llewelyn ap Griffith, Prince of North Wales, whose power had become considerable owing to the dissensions between the King and the Barons, and who claimed to be the over-lord of Senghenydd. Llewelyn attacked, and to some extent destroyed Caerphilly Castle while in course of building. There were protracted negotiations for the settlement of the dispute, many documents relating to which are printed in Mr. Clark's "*Cartæ*" &c. Vol. I., but these never led to any actual settlement, and meantime the building of Caerphilly Castle continued. The ultimate fate of Llewelyn and the subjugation of North Wales are matters of general history.

It may as well be mentioned here that de Clare's Castle of Caerphilly was certainly the first erected there by the Norman or English Lords, whatever may have been the date or nature of the early fortress which gave the place the name of "Caer."

It was clearly not (as has been supposed by some writers) the Castle of Senghenydd destroyed by the Welsh, as mentioned in the *Brut y Tywysogion*, in 1217. That was evidently¹ somewhere in Gower, probably at the place now known as Llangenydd. Castell Coch also appears to have been built by this Gilbert de Clare.

Contemporaneously, no doubt, with the building of the Castle, it is evident that a borough was founded at Caerphilly, which in all probability had a charter or charters like the other boroughs. The mention of burgesses and burgage rents in several inquisitions and accounts makes the existence of a borough clear. Rhys Myrkyke refers to it as "sometime a Borough Towne, but now using noe liberty," so that in his day

(1) This clearly appears from the context. Besides, Senghenydd was then in Welsh hands.

it had lost any privileges it may have possessed, though at what period this occurred is not recorded.

In 1295, the year of the death of Gilbert de Clare, there was a great Welsh rising, which was put down by King Edward I. in person, but not before it had disastrous effects in Glamorgan.

At Caerphilly, and throughout Senghenydd, there seems, from the Inquisition taken almost immediately after, on the death of de Clare, to have been nearly complete destruction of everything but the Castle.

It is said that, at Caerphilly there was a good and well fortified Castle, but the receipts, apart from Whitchurch, come to only a few shillings. There are mentioned 80 burnt burgages, which used to yield before the war £2; two mills which used to yield £10 6s. 8d. are worth nothing; and pleas and perquisites which used to be worth £2 are also of no value.

At Whitchurch (Album Monasterium) we find a different state of things. Though the mill had been burnt the whole receipts come to £9 4s. 2d. Rents of customary tenants are mentioned there (a thing generally unknown throughout the great hill Lordships), and I think this fact, and the name of the place and condition of things generally, rather indicate that Whitchurch may have been annexed earlier than the rest of Senghenydd.

The Inquisition of 1307, on the death of Ioan de Clare, shows a very different state of affairs. A few years peace had brought the total receipts to upwards of £96.

In 1314 the total was £108; in 1349, £237. In 1375 it is put at £194, but there is good reason to think that it is here much understated.

The Inquisition of that year (on the death of Edward le Despenser) was taken at Gloucester, and not locally, as had been the case on former occasions, and an actually extant Minister's account for Senghenydd subtus shows that only about two years before (in 1373-4) that division of the Lordship alone produced £189.

What are called pleas and perquisites made up £144 of this sum, an enormous amount to be exacted in those days for heriots, deodands and fines and forfeitures of various kinds. I think it must be admitted that the rule of the Despensers was probably terribly oppressive, and may well have given rise to the saying which has survived to our own time, by which anything wholly lost is described as having "gone to Caerphilly."

My object has been not to give a history of Senghenydd, but merely to show of what it consisted and by whom it was ruled in the earlier days.

Having shown how it came into the hands of the Chief Lords, I have only to add that it was one of the Lordships granted by King Edward VI. to Sir William Herbert on the 7th May, 1550, and has ever since remained in the possession of those deriving title under him, the Marquess of Bute being the present Lord.

MISCIN.

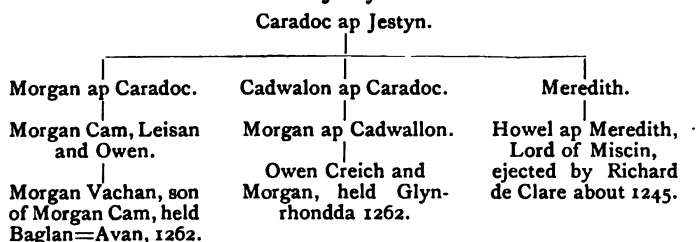
This is another of the old member Lordships, which, like Senghenydd, remained in the hands of Welsh Lords for long after Fitz Hamon's time, though as we shall see, this remark may have to be qualified to some extent as regards its southern portion.

It is bounded by Senghenydd on the east, on the north by Brecknockshire, on the west for the most part by Glynrhondda, though it also abuts upon Ruthyn, Talafan and Talygarn, while on the south it has the old manors or fees of Peterston and Saint Fagans, and a part of Llandaff. The bounds on the west and south are well ascertained, but are by no means coincident with those of parishes.

Over this large district, in the times succeeding the Norman conquest, descendants of Jestyn ap Gwrgan ruled.

That the following remarks as well as some with regard to

Glynrhondda may be clear, it will be well to give the names of some of these descendants of Jestyn:—



I do not mean that the above pedigree includes all the sons of the different persons, but so far as it goes it can be proved by old writers of authority, or by extant charters.

A charter¹ of King John, of 1205, confirms to Margam common of pasture in the mountains between Taff and Neath Rivers. John was at this time holding the lordship of Glamorgan, which he had obtained in right of his wife Isabel, daughter of William Earl of Gloucester. It confirms the grant as one which had been made by Morgan ap Caradoc, and the fact of the grant indicates that Morgan was Lord of the whole of the hill district between the two rivers named.

This evidence does not stand alone, for a grant of a certain Caradoc Uerbeis of land in Miscin, on the borders of Glynrhondda (afterwards part of the land appertaining to the Monastery of Penrhys) was made with the consent of the grantor's Lord Morgan ap Caradoc.

This Morgan was living in 1188, and guided Giraldus Cambrensis and Archbishop Baldwin over the marsh beyond Neath, as Giraldus states.

Another son of Caradoc ap Jestyn was named Meredith, and according to a statement in Mr. Clark's Glamorgan Genealogies it appears that in 1245-7 he was Lord of Miscin and was dispossessed by Richard de Clare. The statement is confirmed to some extent by other authorities, for it appears from the proceedings by Richard de Clare against Richard Siward, (referred to in dealing with Llanbleddian), that Howel was

(1) Rot. Chart., p. 149. Cartae I., p. 46.

concerned in the disturbances which led to the forfeiture of Siward's lands.

It will also be remembered that he was one of those who gave trouble in 1242. The *Brut y Tywysogion* also, under date 1246, mentions a Howel ap Meredith, who had been entirely dispossessed by the Earl of Clare.

The above history is no doubt the true one, and the legends which describe Fitz Hamon as having retained Miscin for himself inaccurate, as also in all likelihood is the story of Robert of Gloucester having built a castle there, before 1147.¹

Mr. Clark ("Land of Morgan," p. 48) considers the existing remains of Llantrisant Castle probably referable to the reign of Henry III. This, of course, is consistent with its having been built by Richard de Clare on the expulsion of Howel ap Meredith. A document amongst the Penrice MSS., dated 1246,² refers to the bailiff of the Castle of Llantrisant, so that it had been built by that time. The history of the town of Llantrisant, so far as it can be made out from the accounts, seems to indicate the time of Richard de Clare as that of its foundation. We know that in Llantrisant, as in Cardiff and Cowbridge, the rent of a burgage was 1s., and that fractional parts of burgages were known. According to the extent of 1262, the borough rent of Llantrisant was only 13s. 4d., while in 1307 there were 145½ burgages, yielding £7 5s. 6d.

I do not mean that the place was unoccupied prior to Richard de Clare's time, but I think it seems probable at least that he founded the Castle and Borough.

From the time of Richard de Clare onwards the Lords of Cardiff have also been Lords of Miscin, except indeed for about three years in the time of King Edward VI., who granted Llantrisant to Sir William Herbert, 10th July, 1547, but did not grant him Cardiff until 7th May, 1550. Within the bounds of Miscin are part of the manor of Penrhys, and the whole of the manors of Pentyrch, Clun and Radyr.

(1) Date of his death.

(2) *Cartae III.*, p. 424.

Penrhys is the territory granted in the time of the Welsh Lords, to the Cistercian Order, and which appears to have belonged at first to Margam and afterwards to Caerleon, and at the time of the dissolution of the monasteries, to Llantarnam. The so-called manor of Penrhys is partly in Miscin and partly in Glynrhondda, which lordships were probably¹ in the same hands at the time of the original grants.

Pentyrch was, in 1262, entered in the extent of that time as a manor held of the chief Lord by Henry de Sully, but does not appear in subsequent accounts, and probably soon returned to the hands of the chief Lord.

Of the origin of Clun as a manor I know little or nothing. It is referred to by that name in a writ dated 1317² directing the delivery of a share of Gilbert de Clare's lands to Hugh le Despenser in right of his wife Eleanor de Clare. For several centuries Pentyrch and Clun have been considered as one under the name of the manor of Pentyrch and Clun, and as members or a member of Miscin, but the fact of there being copyholds held of the manor of Pentyrch and Clun seems to indicate perhaps an earlier annexation than that of the rest of Miscin.

Radyr also is described as a manor in the writ of 1317, but was then and for long afterwards in the hands of the chief Lord, and though leased in the time of Henry VII., was never granted in fee. It has long been treated as simply a part of Miscin.

The southern boundary of Miscin runs through the parish of St. Fagans, and I suggest that it is likely that the manor of St. Fagans, as well as those of Radyr and Pentyrch and Clun, may have been encroachments after the original invasion of Fitz Hamon, but earlier in date than the final expulsion of the Welsh Lords of Miscin.

The name Miscin, like that of Senghenydd, is no doubt older than the Norman Conquest, but while the boundaries as marked on the map represent the member lordship incorporated

(1) *Id.*, in those of Morgan ap Ioradoc.

(2) *Cartae* IV., p. 68.

with the County by the Act of Henry VIII., it is probable that on the south the district known by that name would be of greater extent in the old Welsh times.

From the expulsion of Howel ap Meredith onwards Miscin remained in the hands of the chief Lord, and was granted by King Edward VI. to Sir William Herbert, 10th July, 1547, being a portion of the first grant to him.

GLYNRHONDDA.

This district lies to the west of Miscin, and comprises the parish of Ystradfydwg, and parts of Aberdare, Llanwonno, and Llantrisant.

It is one of those which is by some writers stated to have been retained by Fitz Hamon, but this, as in the case of Miscin, cannot have been so in fact.

It was clearly under the rule of the descendants of Jestyn ap Gwrgan down to the middle of the 13th Century. The confirmation by King John of a grant by Morgan ap Caradoc of common of pasture between the Taff and the Neath, I have already referred to, and in the extent of 1262 it is stated that at that time the two sons of Morgan ap Cadwallon held Glynrhondda.

The pedigree which I have given in treating of Miscin shows that Cadwallon was a son of Caradoc ap Jestyn, and brother of Morgan ap Caradoc.

The exact words of the extent of 1262 are that these two sons held "half a commote" in Glynrhondda, which may perhaps mean that they held part only of the Lordship now known by that name. The rest may perhaps have been taken by Richard de Clare, when he seized Miscin.¹

Under what circumstances Welsh Lords ceased to hold Glynrhondda I do not know, but, as we have seen, the policy of taking possession of the member Lordships seems to have been the regular policy of the de Clares at this period, and whatever the exact date may have been, it is evident, from the

(1) It is also possible that it was only half a commote from its wild nature. These old divisions were very unequal in area.

Inquisition on the death of Gilbert de Clare in 1295, that by that time Glynrhondda had come under the direct rule of the chief Lord.

The Inquisition, after dealing with Llantrisant, states that there was rent of Glynrhondda £5 8s. od., and pleas and perquisites, £2.

As in the case of Senghenydd, the receipts were probably low in that year on account of the recent rising, but even in the oppressive times of Hugh le Despenser the rents only seem to have been about £15, while the exactions under the head of pleas and perquisites came to £30, as compared with £80 in Misco.

The district, though extensive, must always have been a wild and poor one, inhabited by a purely Welsh population.

No castle appears ever to have existed within its bounds, and I suppose it was administered from Llantrisant.

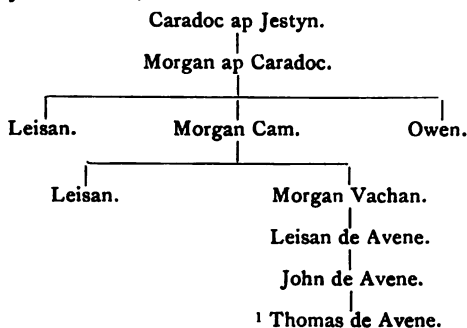
It was granted to Sir William Herbert in 1547.

AVAN.

This Lordship, now known as Avan Wallia, was held for many generations by the descendants of Caradoc ap Jestyn.

Its boundaries as shown on the map are taken from surveys of the 17th Century, and there is no reason to doubt that they show the limits of the Lordship in the later mediæval times, through its earlier Welsh Lords probably claimed a much more extensive rule.

The descent, which can be well established from the charters published by Mr. Clark, was as follows :—



(1) Perhaps also another Thomas.

Of these Morgan ap Caradoc was at times at war with William Earl of Gloucester, and Morgan Cam was repeatedly in arms. This latter gave much trouble to the Norman Lords, and also to the monks of Margam¹, with whom, however, he was sometimes on good terms. By one of his charters² he purports to confirm a grant by Gilbert de Clare (the first Lord of Glamorgan of that name who died in 1230), thus showing that he did not then acknowledge a superior. He claimed to be Lord of Newcastle, and by another charter³ confirmed to the monks their possessions there while expressly reserving his right to fight with others.

In the Annals of Tewkesbury he is said to have died in 1240 and to have been buried at Margam. According to the extent of 1262 Morgan Vachan, son of Morgan Cam, is said to have held half a commote in Baglan (meaning no doubt the same as the Lordship of Avan) owing no service but a heriot at death.

This family alone among the Welsh Lords (so far as is known) assumed the right of granting charters to a borough,⁴ namely Avan, now known as Aberavon.

Two such are known, one granted by Leisan,⁵ son of Morgan Vachan, and the other a confirmation by his grandson Thomas⁶ in 1350.

This Leisan appears to have been the first who was called de Avene, by which name his descendants were known.

A pedigree, given in Mr. Clark's Genealogies, makes the de Avene line end with Jane, stated to have been a daughter of Thomas ap Thomas ap John ap Leisan who married Sir William Blunt and exchanged Avan for lands in England. The fact of an exchange is also mentioned in a MS. of the time of Elizabeth called "a Breviat" by Rice Lewis.

This transaction may have been with Edward le Despenser (1357-1375), for in 1350 as above stated, Thomas de Avene

(1) Annals of Margam, &c.

(2) Cartæ III., p. 853.

(3) Cartæ L., p. 71.

(4) One of the "marcher" privileges.

(5) Cartæ L., p. 203.

(6) Cartæ II., p. 2.

granted a charter to Avan, while in 1373 Edward le Despenser granted a charter to "our burgesses of our town of Avan."

I feel some doubt, however, whether the lordship had in fact come into the hands of Edward le Despenser, for it is not mentioned in the inquisition taken on his death, and the charter last mentioned in no way deals with the affairs of the Borough generally, but grants freedom from toll throughout the Lordship of Glamorgan, which of course the chief Lord could grant without being immediate Lord.

In this respect it is like some of the charters granted by Kings of England to Cardiff,¹ &c., at times when the Lordship was not in the King. It will be observed that these deal only with extraneous matters such as freedom from toll throughout England, and do not purport to regulate the internal affairs of the Borough.

I have been unable to ascertain with certainty at what date the exchange took place by which the Lordship of Avan came into the hands of the chief Lord.

It was one of the Lordships granted by King Edward VI. to Sir William Herbert in 1550, and remained in the possession of his descendants till 1715, when it was sold to Sir Humphrey Mackworth.

I believe the Earl of Jersey is the present Lord.

Resolven, shown upon the map, no doubt originally formed part of this Lordship, but was granted to Margam Abbey as early as the days of William Earl of Gloucester and Morgan ap Caradoc. This is abundantly proved by charters, but space forbids entering upon the details here.

NEATH.

The Lordship of Neath, of whatever it may have consisted at that early date, fell at the first conquest into the hands of de Granville, said to have been Fitz Hamon's brother. He, or perhaps his son, founded Neath Abbey in 1129, and the foundation charter mentions the Castle of Neath.

(1) See Cardiff Records, Vol. I.

I cannot here deal with the question of the exact bounds of the territory which the grant to Neath Abbey may have comprised, but it must have included nearly all he had in that district, but largely consisting of waste or mountain land, and probably far more than his Welsh neighbours would have admitted that he had any right to grant. In fact the rights granted to Neath at that time seem to have amounted to little more than leave to reclaim and possess, if they could, a large tract of waste land, and certain fisheries, &c.

The "member" Lordship of Neath as it existed in later times was no doubt made up of what de Granville retained in his own hands, added to those portions of the Abbey lands which, in the time of Edward I., Gilbert de Clare acquired by exchange. There continued in the hands of the Abbey, up to the dissolution, the manor of Cadoxton-juxta-Neath.

Very shortly after the foundation of the Abbey, de Granville, whose position was rendered very precarious by the Welsh, seems to have resigned Neath to Earl Robert of Gloucester and retired to his Devonshire estates. The actual truth probably is that he was either driven out, or retired because he felt that he could not hold his own. There is no doubt that there was a great and successful rising of the Welsh in 1135-6.

The history of Neath was a stormy one for long after this, during the time when the castle was held on behalf of the chief Lords, and most of the surrounding district was claimed by the Abbey. The town was attacked, and narrowly escaped by the arrival of aid in 1185, and in 1231¹ it was taken and burnt by the Welsh Prince Llewelyn ap Iorwerth and Morgan Cam, Lord of Avan, the latter of whom is said to have exterminated the inhabitants.

The extent of 1262 shows that the town had in some measure recovered, the burgage rents amounting to £5 12s. od. It is noted, however, that there were 150 burgages burnt and destroyed.

(1) *Annales de Margan.*

On the 10th of April, 1289, Gilbert de Clare effected an important exchange with the Abbot,¹ which in effect constituted the Lordships of Neath citra and Neath ultra, as afterwards known. He acquired the bulk of the Abbey lands, granting in exchange £100 per annum to be paid to the Abbey. The Abbey retained, as already stated, what is now the manor of Cadoxton-juxta-Neath.

The money to be paid yearly in exchange was to come from the following sources :—

	£	s.	d.
From the burgage rents of Neath...	5	14	4½
„ „ „ Cowbridge ...	14	12	7½
„ rent of manor of Llanbleddian...	23	5	7½
„ „ „ Llantwit ...	25	17	0¾
„ burgage rents of Cardiff...	20	3	0
„ „ „ Caerleon ...	10	7	4
	£100	0	0

This, it may be noticed, gave rise to the “Abbot’s rents,” often mentioned in later years in connection with the places named, and in Cardiff at least, to a certain amount of confusion as to whether the burgage rents belonged to the Crown (after the dissolution of the monasteries) or to the Lord of the borough. The actual fact was that the burgage rents fell to much below £20, so that the whole went to the Abbot, and after the dissolution to the Crown in right of the dissolved Abbey; but the right of escheat and all other rights of lordship remained with the Lord, being expressly reserved out of the grant of 1289.

At first the Abbot would seem to have had the best of the bargain, for in the Inquisition on de Clare’s death, in 1295, the income of the whole (reduced no doubt by the rising of that year already mentioned) was only estimated at £16 5s. 6¾d.

However, in 1307 the valuation was £51 18s. 10¾d., and in 1314, £90 19s. 4½d.

(1) *Cartae* III., p. 194.

Immediately after the rising of Llewelyn Bren in 1316, the receipts for half a year were about £31, but on the death of Hugh le Despenser, in 1349, the yearly value was put at £128 12s. 6d.; Welsh tenants in the hills rendering £36 5d., and the pleas and perquisites, £60.

These were of course just the items of revenue which would disappear in case of disturbance.

Neath remained in the hands of the chief Lords, came with the rest to King Henry VIII., and though not included in either of the grants to Sir William Herbert, was afterwards purchased from Queen Elizabeth and held by the Earls of Pembroke and their successors until sold to Sir Humphrey Mackworth in 1715. It now belongs to the Earl of Jersey.

TIR-Y-IARLL.

Coming now again to the eastward the next member is Tir-y-Iarll, consisting of the two large parishes of Llangynwyd and Bettws. The name of course means "the Earl's land," but so far as I have observed the earliest documents call it Llangunith, or some form of Llangynwyd. There is, as in the case of Miscin and other districts a doubtful legend that Fitz Hamon retained it in his own hands. Certainly the name of "Earl's land" seems to indicate that it was in the possession of the chief Lord at an earlier date than the neighbouring districts, but at what date it ceased to be under Welsh Lords I have not ascertained. In the extent of 1262 it is called Langunith and I think it possible that it may have acquired the name of Tir-y-Iarll about that period, *i.e.*, in the time of Richard de Clare or his son Gilbert. It is called by that name in the Inquisition of 1295. In a charter which must be of the year 1246¹ (many of the names of witnesses corresponding to a dated deed of that year), the Castle of Languneth is mentioned. In 1295, under Tir-y-Iarll, "a castle burnt in the war" is mentioned, while in 1307 what is doubtless the same place is called the "site of an ancient castle." It does not seem to

(1) *Cartae I.*, p. 269.

have been rebuilt as the later inquisitions make no mention of a castle there. This point might probably be decided by an inspection of the ruins, of which Mr. Halliday has informed me considerable remains still exist. On the Ordnance map it is called Castell Coch.

The district was always in the hands of the chief Lord, and was granted to Sir William Herbert in 1550. It was sold to Sir Humphrey Mackworth in 1715, and I believe now belongs to Mr. Charles Evan Thomas.

COYTY.

This Lordship alone among the greater "members" has the peculiarity of never having been from the first in the hands of the chief Lords.

It was taken by the Turbervill family, at or very soon after Fitz Hamon's conquest. The original Turbervill owner is said to have married the Welsh heiress, and so acquired a more legitimate title than that of conquest, but if this was so, and if, as some accounts allege, the lady was a great-granddaughter of Jestyn ap Gwrgan, the marriage must obviously have been much later than Fitz Hamon's time.

A Turbervill witnessed the agreement of 1126 between Bishop Urban of Llandaff and Earl Robert of Gloucester.¹ I think the earliest documentary evidence which I have seen showing the connection of the family with Coyty is an entry on a roll of 1199 when a Paganus de Turbervill gave King John 10 marks and a horse that a suit between him and Walter de Sully concerning lands in Coity might be respited.²

At this time the Lordship or "Honour,"³ as it was then sometimes called, of Glamorgan, was in the hands of the King through his marriage with the daughter of Earl William.

In after years there is ample documentary evidence that several generations of Turbervills were Lords of Coyty with the most ample jurisdiction and privileges, and in the extent of

(1) *Liber Landavensis*.

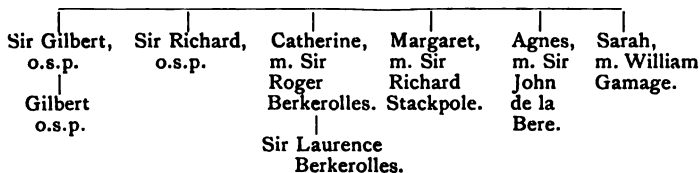
(2) *Rot. de oblatis*. Cartae L., p. 36.

(3) I do not find this expression as to Glamorgan after this period.

1262 a Gilbert de Turbervill is said to hold the "Honour" of Coyty by the serjeanty of hunting. In the writ to the Escheator for giving effect to the partition of the estates of the last de Clare Lord the "Serjeanty" of Coity is assigned for (*i.e.*, deemed equal to) 4 knights' fees.

The holder at that time, according to the writ, was Sir Payn Turbervill, but it would seem that he must have been in fact dead at that actual date if an account printed in vol. i of the "Cardiff Records" is correct. He had been custodian of Glamorgan, and the account of his dealings in that character is up to 20th April, 1316, and is rendered by his widow. Possibly the particulars in the writ had been prepared some time before and not brought down to date.

This Turbervill¹ according to the account in Mr. Clark's Glamorgan Genealogies, p. 454, materially corroborated by the Inquisition on the death of Sir Laurence Berkerolles¹, hereafter referred to, left issue as follows:—



The descendants of the daughters need not be traced for present purposes.

An Inquisition on the death of Sir Laurence Berkerolles, taken 7th December, 1411, shows that he had entered upon the castle manor and Lordship of Coity in right of himself and others interested, and states that the same were held of Richard le Despenser (then a minor and ward of the King) "as of his Lordship of Cardiff."

The Lordship of Coyty ultimately came wholly into the possession of the Gamages, descendants of William and Sarah.

By the marriage of Barbara Gamage, the ultimate heiress, with Robert Sydney, second Earl of Leicester, in the time of Queen Elizabeth, Coyty came to the Earls of Leicester (with

(1) Cartæ II., p. 75.

much other Glamorgan property) and with them it remained until the death of the 7th Earl in 1743, when, after litigation and a compromise it came into the possession of his natural daughter Anne, who married Henry Streatfield, of Chiddingtton, Kent.

The Earl of Dunraven is the present Lord.

I am not aware whether any documents exist throwing light upon the subject of the administration of this Lordship in the times before the passing of the Statute of Henry VIII. Any such would be of special interest as affecting the only "member" lordship not in the hands of the chief Lord.

It would be interesting to ascertain what exactly were the rights which the Lords of Coity in fact exercised as distinguished from the Lords of ordinary manors.

LLANBLEDDIAN, RUTHYN AND TALAFAN.

I think it convenient to take these three central Lordships together, for although their boundaries as manors for the last three centuries are well ascertained, their early history is very obscure, from the fact that all were and apparently had been for some time prior to 1245 in the hands of the same Lords, the Siwards, and afterwards were in the hands of the Lords of Glamorgan, until Talafan was separated from the rest in the time of Henry VIII. or Edward VI.

As to Ruthyn, it consists in modern times of two portions, known as the higher and lower lordships lying in the parishes of Llanharan, Llanilid and St. Mary Hill.

It is certain, however, that Gelligarn, formerly a manor of Neath Abbey, and comprising the remainder of the parish of St. Mary Hill was within it, and so no doubt was Milton which belonged to the Order of the Knights of St. John, and of which last I believe Mr. Blandy Jenkins is now Lord.

The tradition is that in the times immediately succeeding the Conquest, Rhys, son of Jestyn was Lord of Ruthyn, and this receives confirmation from the fact that a charter of King

John, 1208,¹ confirmed to Neath Abbey the land (doubtless Gelligarn)² which they had of the gift of Rhys, son of Jestyn.

In 1245, it appears to have been under Richard Siward, who is further referred to below, and to have passed, with his other manors of Llanbleddian and Talafan, into the hands of the chief Lord. Like those Lordships, it is not mentioned at all in the extent of 1262. In 1295 it is put down as worth £1 5s. 8d. In 1314 it is included in the Llantwit return, probably being then administered by the officers of that manor. In 1349 it was valued at £14 3s. 1½d., and in 1375 at £13 10s. 8d. per annum.

As to Llanbleddian, the history is somewhat different. Like Ruthyn, its bounds were formerly of much greater extent than at present. St. Hilary, Llanquian, and Llandough were certainly in the ancient member lordship, and the same may very probably have been the case with that portion of the parish of Llanbleddian which is now regarded as in Talafan, and Llansannwr, the advowson of the Church of which belonged to Llanbleddian in the time of the last de Clare, but which parish also now forms part of Talafan. I have treated Llanquian on the map as part of Llanbleddian, though perhaps this is not quite consistent with omitting St. Hilary, &c.

The earliest boundaries may well have been still wider than the above remark would indicate. What was the exact nature of the transactions by which the various manors which seem to have been held of the old lordship were severed from it, it would probably be impossible now to ascertain with certainty, nor have we any means of knowing exactly of what the member of Llanbleddian consisted when it fell into the hands of the chief Lord.

There can hardly be any doubt, however, that Llanbleddian formed part of the original conquest. We know that its church was one of those granted by ³Fitz Hamon to Tewkes-

(1) *Cartae I.*, p. 89.

(2) They had no other near.

(3) Confirmation by Bp. Nicholas. *Cartae I.*, p. 21.

bury, with, it would seem, the chapels of Cowbridge and Welsh St. Donats. Mr. Clark, in the "Land of Morgan," states that the St. Quintin family held Llanbleddian, and the castle is otherwise known as St. Quintin's, though the present building can hardly be of the time of that family for the following reason :—The de Clare Inquisitions of 1295 and 1307 make no mention of any castle there, while that of 1314 speaks of one "begun" by the Earl, which fixes the date of the building of the existing castle at from 1307, when the Earl was admitted to possession of his estates, to 1314 when he was killed at Bannockburn. This seems clearly to show that if there was any castle there before it must have fallen into decay.

I can find no mention of the St. Quintin's in connection with Glamorgan later than the first quarter of the 13th Century.

By 1245, in whatever way this may have come about, Richard Siward, a powerful baron, was Lord of Llanbleddian, Talafan, and Ruthyn. His castle was that of Talafan, of which ruins still remain. He was accused of levying war in the County against the peace of Earl Richard de Clare, and certain proceedings in the Comitatus or County Court of Glamorgan, before the Sheriff and the Glamorgan Barons, ended in his being outlawed and his lands forfeited. He appealed to the King, but the Earl alleged that the matter belonged to his jurisdiction and had been duly decided.¹ The actual result is wanting, unfortunately, but it would seem that the forfeiture held good, for it does not appear that Siward subsequently had the lordships. As already stated, they are not mentioned at all in the extent of 1262, but in 1295 they were in the hands of the chief Lord. According to Matthew Paris, Siward died in 1248.

With regard to the town of Cowbridge, which at the end of the 13th Century, was second only to Cardiff among the boroughs of Glamorgan, there is much difficulty. One tradition is that Fitz Hamon retained it in his own hands, but this, considering that it is entirely surrounded by the Lordship of

(1) Cartae I., p. 86.

Llanbleddian, seems very unlikely if Llanbleddian was at that early date granted out. Unfortunately its early charters are missing and early allusions to the place are very scanty, but, in the absence of direct proof it does not seem impossible that it was founded by some of the earlier Lords of Llanbleddian. I merely suggest, however, that it seems extremely improbable that, being in a "member" lordship it was in other hands than those of the lords of that lordship.

As to Talafan, I have already stated what little I know of its earlier history and the reasons which make it impossible now to determine whether its present bounds are those of early times, mixed up as it is in its history and ownership with Llanbleddian.

Talafan was sold either by Henry VIII. or Edward VI. to John Thomas Bassett. The Glamorgan Genealogies give 1545 as the date, but the MS. Breviat of Rice Lewis says it was acquired of Edward VI.

Its devolution afterwards was as follows:—

Elizabeth, daughter of John Thomas Basset married Anthony Mansel.

Mary Mansel, their daughter and co-heiress, married Sir Thomas Aubrey, and the lordship thus came to the Aubreys in whose descendants it remains.

I should add that I think it probable that Caerwigau, forming the south-western portion of Pendoylon¹ may have been part of the member of Talafan, though now reputed to be a distinct manor. ♦

Ruthyn and Llanbleddian were among the manors granted to Sir William Herbert in 1550.

I have now noticed all those member Lordships which were always regarded as such in the strictest sense, and which were for a considerable time in the enjoyment of a greater or less degree of independence. There are, however, some others which for one cause or another, stood in a different position

(1) It perhaps was the half Knight's fee in Pendoylon held by William ap Phillip in 1317. Writ to Escheator.

from ordinary manors, and which it was thought needful to mention specially in the Statute of Henry VIII.

These are, LLANTWIT, OGMORE, TALYGARN, and LLANDAFF.

LLANTWIT was and is distinguished as one of the most fertile districts in the vale, and there appears to be some reason to suppose that the Welsh rulers of Glamorgan had a residence at Boverton.

For one or both of these reasons probably, the chief Lords appear to have from the first conquest kept it in their own hands. Its church and certain lands were granted by Fitz Hamon to Tewkesbury Abbey, and these lands formed at a later period the so-called manor of West Llantwit, or Abbots Llantwit, a portion of the Stradling estates. There is also, in the western part of Llantwit, the small sub-manor of Llantwit Rawley, formerly held by the Raglan family, but which has been in the possession of the Lords of the principal manor since the time of Elizabeth.

In the Inquisition of 1314, Llantwit is mentioned together with Ruthyn as constituting "a member" of the County, but from the context I am inclined to think that this merely means that Ruthyn was for some administrative purpose connected with Llantwit, rather than that Llantwit was of itself a "member" Lordship.

Still it is a fact that it is mentioned in the Statute of Henry VIII. as a district to be added to and thenceforth to form part of the County. In old documents it is sometimes called Boverton or Boviarton, and the present full name of the manor is Boviarton and Llantwit.

It was granted to Sir William Herbert in 1550.

TALYGARN or Talagarn presents much difficulty. It is mentioned in the Statute of Henry VIII., but I find no reference to it in the Inquisitions. Its lords are said by Rhys Myrkye to have been "Lords of tree and pit," that is that they had powers of life and death, but why the Lords of so comparatively

small an area should have had these privileges I have not been able to ascertain. I think it likely that it remained in the hands of Welsh Lords. Rice Lewis, in his *Breviat*, states that Harry Morgan Lewis purchased the manor, but does not state when or from whom.

Mr. Clark in a note, *Cartæ II.*, p. 270, states that the Lordship was held by Jenkins of Hensol, and so passed to the Earls of Shrewsbury, Lords Talbot of Hensol, by whom it was sold to its (then) owner. The then owner was Mr. Clark himself, and the present owner is his son, Mr. Godfrey Lewis Clark.

OGMORE, the old Lordship of the de Londres family, whose ancestor was one of the followers of Fitz Hamon, was considered as consisting of four knights' fees, held by knight's service. But for the fact of its having become vested in the Crown, as part of the Duchy of Lancaster estates, I suppose there would have been no occasion to mention it specially in the Statute of Henry VIII., as no doubt it was part of the old County.

The de Londres family as connected with the Lordship of Ogmores ended in an heiress, Hawise, who married Sir Patrick de Cadurcis or Chaworth. He was killed in battle against the Welsh, 1258, and left an heiress, Matilda, who married Henry, Earl of Lancaster, grandson of King Henry III. Their son Henry, was Duke of Lancaster and father of Henry IV., King of England. Thus the Lordship of Ogmores came into the possession of the Crown and has so remained. Colwinston is a sub-manor of Ogmores.

In speaking of this Lordship of Ogmores I should mention that the territory shown on the map comprises the parish of Llandyfodwg. Though this has been accounted part of Ogmores for several centuries (probably, at least from the time of Henry VIII.), it was no part of the old de Londres lordship.

In the time of the de Clares it was parcel of the County of Glamorgan, under the name of Glynogwr, though not the

subject of feudal tenure, but occupied by Welshmen, as a "*patria Wallensium*," directly under the chief Lord, somewhat like Kibbor, with which it is often connected by name in the old inquisitions.

When the Lordship of Glamorgan came into the hands of the King in the time of Richard III., this district, no doubt, came with it, and I think it likely that from being administered with the adjoining portion of the Lordship of Ogmore (*Llan-geinor*) it became in time considered as part of it. This is an explanation which occurs to me. Others may be able to throw more light on the matter. *Llandyfodwg* certainly was not part of the old Lordship of Ogmore though probably part of the territory intended to be included under that name in the Statute of Henry VIII., and for that reason I have shown it as part of the Lordship on the map.

LLANDAFF was, of course, the Lordship of the Bishop of that See, and the Splott (sometimes described as a manor) was part of it, as were some minor properties in other parts of the County.

The Manor of Llandaff was sold by Bishop Anthony Kitchin to George Mathew in 1553, and continued in the Mathew family until 1818, when it was purchased by Sir Samuel Romilly. His successors sold it to Mr. William Sheward Cartwright in 1853, whose grandson is, I believe, the present Lord.

NOTES ON GLACIAL ACTION IN BRECKNOCKSHIRE AND ADJOINING DISTRICTS.

By F. T. HOWARD, M.A., F.G.S.

LITERATURE.

- Sir R. I. Murchison ... The Silurian System.
 Rev. W. S. Symonds Observations on certain Drifts and Ancient River
 Beds of Siluria and South Wales. Brit. Assoc.,
 Rep. 1865, and Geol. Nat. Hist.
 Repertory vol. i., p. 148, and Records of the Rocks.
 London: J. Murray, 1872.
 T. M. Reade ... Notes on the Southern Drift of England and Wales.
 Proc.: Liverpool Geol. Soc., vol. iv., part iii.,
 p. 216. 1881.
 Moraine of Llyn Cwm Llwh. *Ibid*, vol. vii.,
 p. 270. 1894-5.
 Edgeworth David ... Evidence of Glacial Action in S. Brecknock and
 E. Glamorgan. C.N.S. Trans., vols. xiii.
 and xiv. 1882-83, and
 Q.J.G. S. xxxix., 39-53.
 H. Hicks ... On the Evidences of Glacial Action in Pembroke-
 shire and the direction of the Iceflow. Rep.
 Brit. Assoc., 1891, p. 500, and Geol. Mag., vol. i.,
 p. 191. 1894.
 F. T. Howard and E. W. Small Notes on Ice Action in South Wales. C.N.S. Trans.,
 vol. xxxii.
 F. T. Howard ... Lakes and Tarns of South Wales. C.N.S. Trans.,
 vol. xxxii.
 T. Codrington ... Notes on a Submerged and Glaciated Rock Valley,
 recently exposed to view in Caermarthenshire.
 Abs. Proc.: Geol. Soc., 1901-1902, part i.

PREVIOUS KNOWLEDGE.

Sir R. Murchison in his "Silurian System," referred in a general way to the glacial drift of "Siluria," and showed that material carried from the hills of Central Wales occurs in deposits of varying thickness on the floors of the broader

valleys, near the border counties. But the papers of our fellow-member, Professor Edgeworth David, published originally in the Transactions of the Society, indicated for the first time, that South Wales had been subjected to extreme glaciation, and that the movement of the ice had been usually in a S. or S.S.W. direction. Professor David definitely proved that the valleys of the Neath and Tawe were the principal lines along which the ice flowed, from the Old Red Sandstone uplands of Brecknockshire down to the lowlands, which are now hidden by the waters of the Bristol Channel.

During recent years, the Officers of the Geological Survey have considerably enlarged our knowledge of the glacial deposits, and the results of their investigations may be summarized as follows:—

The high ground of Glamorgan and the counties adjoining on the east and west, which corresponds with the outcrops of the Pennant Grit, Millstone Grit, and Carboniferous Limestone, nourished an icesheet from which offshoots passed down the valleys southwards. **A.** In the lower valley of the Usk glacial gravels are widespread, especially near Abergavenny, and to some extent above that place. These were, for the most part, derived from the Old Red Sandstone hills to the north, though they include a few boulders from the Coal Measures and associated rocks exposed to the south. In the Llwyd, Ebbw Vawr and Ebbw Fechan Valleys deposits from *local* icesheets only occur. Similar deposits are met with in the Sirhowy, Rhymney and Taff Valleys, but are accompanied by material carried from the Brecknock Hills, proving that the icesheet from that region rode over some of the gaps in the Pennant escarpment. Striæ and polished surfaces at various heights afford corroborative evidence. It is probable that the tongues of ice did not extend as far south as the existing mouths of the rivers.

B. In and near the valleys of the Neath and Tawe and their tributaries, the iceflows from the Old Red Sandstone hills were greater and more important, and they left more traces of

their existence, by polished and grooved surfaces on the rocks themselves, and by extensive deposits of Old Red Sandstone debris preserved in the more open portions of the valleys. At the same time the local icesheets contributed a considerable quantity of drift, and the pre-glacial valleys are still partially filled up even near the sea. What would ordinarily be long inlets of the sea are thereby shortened, and several towns, among them portions of Swansea, have been erected on mounds composed of the glacial drift occupying pre-glacial hollows.

C. At the head of the Tawe some indications of an iceflow from *outside* the drainage area, that is, from north of the Old Red Sandstone escarpment, were noticed, and it is clear that ice from the north crossed the water-divide at certain points further to the west, and joined the flow down the valleys of West Glamorgan and East Caermarthen. Again from the icesheet on the hills, now drained by the Amman, besides the normal flow southwards, ice passed westwards to join the main stream from Central Wales, following the line of the Towy Valley.

In Caermarthenshire evidence of a southerly movement of ice, prior to the general subsidence of the land, has been recorded by Codrington. In Pembrokeshire, the great flow down the Irish Sea submerged portions of the present land mass. Some of the boulders occurring there, as noted by Dr. Hicks, may have come from North Wales and Ireland, and even from the Lake District and South-West Scotland, while local flows from the Precelley Range, supplied many additions to the drifts.

Mr. Small and I have indicated further evidence of ice-action in S.W. Pembrokeshire, and have suggested a S. or S.E. flow, by which some of the igneous rocks and chalk flints were carried into the Vale of Glamorgan and as far as Roath Park, Cardiff.

The observation made by Mr. Strahan generally holds true for the whole of South Wales, viz., that in the areas where the icesheets were developed, the deposits are of the boulder

clay type. These pass laterally into gravels, which form the predominant type on the flatter ground.

AREA UNDER EXAMINATION.

I have endeavoured to determine the character of the glacial drift, and the directions of flow, in the district to the north and north-east of that described by Professor David and the Geological Survey. My investigations have been conducted principally in the upper drainage basin of the Usk, in the middle portions of the Wye watershed, and in a small area near the sources of the Usk, which is drained by tributaries of the Towy.

PHYSICAL FEATURES.

A reference to a map will suffice to show, that a line of mountain stretches in a S.S.W. direction from near Hereford to the South of Bredwardine, Hay, Brecon, and Defynnock, where it rises to heights, varying from 1,000 to 2,000 feet above the valleys, which flank it on the north, and it is traceable to the S.E. of Llangadock and Llandeilo, almost as far as Caermarthen Bay.

Along the foot of this ridge, the Wye flows from Three Cocks Junction to Hereford, while the course of the Usk follows the same line further west from Brecon to Trecastle. No great barrier exists between these two portions of the Wye and Usk valleys, as the Llynfi, a tributary of the Wye, rises on a spur close to the Usk, at a point which is less than 350 feet above the level of that stream. Similarly, the sources of the Sawdde, an important tributary of the Towy, and those of the Usk, are in close proximity on the spurs immediately below the main scarp of the Caermarthen Vans. Thus the ridge is bounded on the north by an almost continuous tract of low-lying ground.

The ridge itself is deeply trenched by several rivers, and in addition, passes or "wind-gaps" occur, which have been utilized in the construction of roads and railways. The most important depressions are those at the heads of the Dŵr, above

Dorstone, and of the Rhiangoll at Dinas, near Talgarth; the gorge of the Usk between Brecon and Crickhowell; the pass between the Tarell and the Taff Vawr streams, near the Storey Arms, above the Cardiff waterworks, and that of the Tawe Valley, near Penwyllt. Minor gaps are to be found at the heads of nearly all the tributary streams, whether they flow down the escarpment to the north to join the Usk and the Wye, or to the south, along the dip slopes, and so across Glamorgan, or through the Black Forest of Monmouth.

Another escarpment of less importance, follows a parallel line some 10 or 12 miles to the north. This feature in the landscape, known as Mynydd-y-Groes and Mynydd Eppynt, is clearly defined to the west of the Wye, where it follows the course of the Yrfon as far as Llanwrttyd Wells, and that of the Dulais, its tributary, beyond that point westwards. For a space, the escarpment is less pronounced, owing to the general rise of the surface level, but it is continued in the ridge, which is traceable in a S.S.W. direction along the Towy, from near Llandovery towards Caermarthen. The ridge, where very pronounced, rises to heights of over 1,000 feet above the level of the Yrfon. It is breached by the Wye, which flows through a deep gorge as far as Boughrood, while insignificant wind-gaps lead southwards to the valleys of the Honddŷ, Yscir and Brân, and a well defined pass joins the Dulais valley to that of the Cilieni, a stream which joins the Usk near Defynnock. Several minor passes, parallel to the escarpment, lead from the Yrfon to the tributary streams of the Towy.

Thus the geographical arrangement consists of two escarpments with their accompanying dip slopes. Through all these slopes, deep valleys have been carved by streams, most of which find their way to the Wye, the Usk, or the Towy.

GEOLGY.

The geological structure is equally simple. The northern escarpment is of Silurian rocks; the southern indicates the line of the Old Red Sandstone cornstone group, which is over-

lain by sandstones and conglomerates. The dip-slopes of the Brecknock Hills and the Black Forest are on the Upper Red-beds; the rocks of the gently inclined surface, between the two escarpments described, are chiefly Lower Old Red Sandstone, consisting of soft sandstones and clays, with cornstones. The structure of this surface is somewhat complicated, because the Silurian strata are brought up to the surface by an upfold, about the middle line between the two escarpments, and in the portion of the country lying between the Wye Valley and Merthyr Cynog, about 10 miles to the S.S.W. This exposure, small as it is, had a direct effect on the character of the glacial drift.

The slopes beyond the northern escarpment are on rocks older than Silurian, which include black and blue slates and hard sandstones.

The distribution of boulders and rock fragments, detached from their outcrops, affords a ready means of determining the direction of the iceflow.

SUMMARY.

It may be convenient to summarize the results of my observations, before giving the details themselves.

I consider that the facts noted are best explained (*a*) by presuming the total exclusion from the area under examination of the great icesheet flowing from the north, which left many traces in North and West Wales, and along the border Counties; and (*b*), by assuming the existence of a great icefield in Central Wales, from which offshoots flowed principally down the streams to Cardigan Bay, and along the lines of the Towy and the Wye.

I conceive (*c*) (1), that the southern offshoot overrode Mynydd Eppynt along certain lines, and received tributaries from less important icefields on the Eppynt Hills themselves; (2), that a portion of this stream united with another flow from the Caermarthen Vans and other hills near Defynnock, and escaped along Cwm Dŵr to the Towy; while (3), another

portion, joined by ice from the Beacons ridge, flowed along the Usk through the gorge towards Abergavenny; (4), that the flow, influenced as to direction by the Wye Valley, pressed hard on the northern scarp of the Black Mountains of Monmouth; and while the main stream turned W.N.W. in the same direction as the modern Wye, ultimately escaping into the lowlands along the Golden Valley and round the end of the Bredwardine Hills past Hereford, offshoots overrode the gaps in the hills at Dinas, near Talgarth, and at the Bwlch, and the low ridge of Talyllyn, to join the flow through the Usk gorgê towards Crickhowell.

I base my conclusions as to (a), on the total absence of the typical igneous boulders from the Lake District and S.W. Scotland, and also of chalk flints; and (b) on the intensity of the denudation by ice as indicated by grooving and polishing of rock surfaces; on the distribution of boulders containing fossils; on the thickness of the drift, and its further extension to the south along the lines of the Towy and the Wye; (c 1) on the presence of boulders belonging to Ordovician rocks which are now exposed *en masse* to the North of the Yrfon, in the upper valleys of the streams whose sources are on Mynydd Eppynt; (c 2) on the change in colour and character of the drift near Cwm Dŵr, indicating that in regular succession the waste of the rock on the east passes on to the outcrop of the rock lying to the west; on the presence of boulders of Old Red Sandstone north of the Usk Valley, though all the exposures are to the south, and on the presence of Old Red drift along with a small proportion of Silurian rocks in the Usk gorge, between Brecon and Crickhowell; (c 3) on the abundance of fossiliferous boulders from various horizons in the Silurian series, of grits which are of Pre-Silurian age, along with a few igneous rocks assumedly from the Builth District, resting on the step, which is roughly 1,100 feet above Ordnance datum, immediately below the main Old Red Sandstone escarpment. Drift of this type is very marked behind the village of Llanellieu. On the south side of the escarpment, it has not been discovered in the valleys

of the two Grwynes, the Honddu, or the Escley. Mixed with drift from the Old Red Sandstone, though the pebbles are much reduced in size and number, it occurs near Hereford.

In the Golden Valley, a few fragments with fossils seem to show that, leaving the Wye, the flow in part passed down this wide valley. Pebbles derived from fossiliferous Silurian rocks, and rocks of greater age, occur in fair abundance along the Rhiangoll, and more rarely in the Usk drift near Tretower, in the Llynfi Valley near Llangorse, and on the low ridge between Talyllyn Station and Allt-Esgair.

DETAILED DESCRIPTION.

(a) Country, North of the Yrfon.

Evidence of general glaciation in the region north of the Yrfon exists, and has been described by various writers, especially Murchison, Keeping and Symonds.

My examination has been limited to the region about Builth and Llanwrtyd, though (C. N. S. Trans., vol. xxxii.) I have previously referred to glacial action, which has evidently blocked up many of the valleys near the sources of the streams, causing numerous "llyn" on the hills about Plynlimmon and Drygarn.

Near Llanwrtyd and Llangammarch, gravels occur in the Cerdin and other tributary valleys to the Yrfon, which contain rocks other than those exposed in the near proximity. Some of the slaty rocks in the gravels are striated. Similarly, igneous boulders occur on the higher ground, north of Llanwrtyd, which are certainly not local. Near Builth, the Gelli of Carneddau Hills show exposures of igneous rocks of various types. My former pupil, Mr. E. H. Davies, of Builth Wells Intermediate School, informs me that boulders of these rocks occur to the S. & S.E., but never to the north.

(b) Country between the valleys of the Yrfon and the Usk, to the west of the Wye gorge.

That the Central Wales icesheet pressed hard on the escarpment is clear from the fact that, boulders derived from

rocks, which are older than Silurian, have been carried *over* Mynydd Eppynt, especially into the tributary valleys of the Towy, and on to the hills near the gorge of the Wye. Along the Wye itself, the stream has scoured out most of the glacial deposits, but at Brechfa to the west of Boughrood, polished and striated boulders of fossiliferous Silurian slates, with calcareous concretions, occur on the Old Red Sandstone at a height of 900 feet above the sea. The pool of Brechfa lies entirely in the boulder clay.

A group of streams, which have cut sideways into the escarpment, joins the Wye at Builth and near Gwenddwr some six miles to the south, and each valley caught material from the iceflow. Though the rocks about are not hard enough to preserve striæ, the drift, from the intermingled outcrops of dark blue Silurian shales and red clay belonging to the Old Red Sandstone series, passes in a characteristic manner from one to the other with fair regularity. In the country to the west of the Wye, a dark blue clay, with boulders of grit and slate, together with a few of white quartz, occurs in the Duhonw Valley just where it broadens out north of Llangynog. In the Offeiriad Valley, subsequent denudation seems to have removed almost all traces of ice-action, though harder grey grits, not of Old Red Sandstone type, occur on the Old Red Sandstone outcrop, north-west of Gwenddwr.

The abundance of local rocks, in the boulder clay heaped up in the valleys, suggests that even the comparatively low ridge of Mynydd Eppynt possessed a minor icesheet of its own. The Dulais, which joins the Llynfi at Talgarth, flows N.N.W. from near Talachddu, but from its source to that place it follows a S.S.E. direction. It rises near the anticline which brings up Silurian rocks. This exposure of Silurian strata is here four miles wide, and boulders and pebbles of Old Red Sandstone and occasional cornstones occur on the outcrop. In the valleys of the tributary streams running over the Old Red Sandstone to the east and west, boulders of yellow sandstones and bluish-grey slates containing fossils are abundant, and the

boulder clay still clings to the valley sides, though the colour of the Old Red Sandstone predominates. When traced down stream, Old Red Sandstone drift becomes more and more characteristic, and only occasional representatives of the Silurian strata appear in the alluvial gravels of Velinfach, though they are plentiful above Trawsgoed. They occur in greater numbers in the streams and on the hills near Llandefallte. Similarly, along the Brecon Honddu, the clayey drift, with Silurian and older rocks, is abundantly preserved near its source; becomes more markedly of Old Red Sandstone type towards Upper Chapel; then on the adjoining high ground, as near Gaer Fawr, boulders of Old Red Sandstone, etc., overlie Silurian rocks, and Silurian pebbles are fairly abundant near Llandefaillog-fach and Garth-brengy, where Old Red Sandstone forms the surface rock. It is to this area that Murchison ("Silurian System," page 339) refers—"Not a single boulder occurs amidst the dome-shaped hills or sharp-ridged hills of the axis of elevation, though there are within their range numerous hollows and deep cavities ready formed for the reception of such drift, whilst broken materials derived from these very hills are piled up sometimes in enormous masses on the exterior slopes of the elevated chain. See many of the hills between Lower Chapel and Brecon, etc."

Near the sources of the two Yscirs and the Brân, moundy ground, with peaty deposits, seems to represent glacial accumulations, and the drift spreads down the valley for some miles. In the Yscir Fawr, half-a-mile north of Bwllfa-uchaf, and near the junction of its two principal streamlets, the river hugs the eastern flank of its pre-glacial ravine, while the greater part of the valley remains filled with boulder clay, into which it cuts with many a curve. In colour the drift is red, but the boulders and pebbles, which are smoothed and striated, include conglomerates, sandstones and shales, derived from the old red series; greenish and grey laminated mudstones and fine-grained yellowish sandstone, all containing Silurian fossils; and red quartzose grits and white vein quartz pebbles representing rocks of greater age (Plate I., Fig. 1).

Boulders up to 2½ feet across occur 200 feet above the course of the stream. In one spot, the boulder clay is banked against a ridge of sandstone to a height of over 30 feet, the stream escaping by a small waterfall over the barrier. At another point, the whole of the valley seems to have been dammed up by a deposit, now 40 to 60 feet high, the stream bending round it and cutting into the rock at Pwll-Gam, while a tributary has cut a gorge parallel to the glacial bank just below it. It is probable that this bank once supported a glacial lake, just as, according to Mr. W. Gibson, the drift caused a series of lakes in the Neath Valley. It is possible that the deserted courses represent a stage of "meandering," when the lake was existing, the desertion being the natural consequence of increased velocity at certain points, when the lake had been drained.

While there is little drift in the lower portion of the Cilieni Valley, numerous boulders occur on the Old Red Sandstone outcrop, near the pass leading to the Dulais, near Abercynnog, and also about the stream Nant Bran, the source of which is close to a brook running north to the Dulais. Some of the boulders are of large size, and many are at least 3 feet in length. The predominant type is a red felspathic and occasionally micaceous rock, which was derived from the outcrop of the Llandovery series, while there are also fine red and green felspathic grits and conglomerates, fine-grained green sandstones, greenish and greyish laminated sandstones, and white vein quartz pebbles. Their position and character suggest that the Central Wales iceflow crossed the ridge through the Abercynnog pass.

Boulder clay and gravels with the same characteristics, as in the Yscir Valley, occur in the upper reaches of the Clydach and Gwdderig, and the sources of the streams lie among mounds apparently of glacial origin.

West of Nant Gwdderig Silurian rocks rise from beneath the Old Red Sandstone, and Tresglyn drains a limited area entirely composed of Silurian strata. It is worth noting that Tresglyn and the other streams to the west run along lines parallel to

the strike, and in the same direction as the neighbouring portion of the Towy.

The boulder clay of Tresglyn is red in colour, and the boulders include many from the Old Red Sandstone, particularly on the east side of the stream. Many are smoothed and striated, and a few are polished. On the west side of the valley the colour of the drift is much lighter, and Old Red Sandstone boulders are practically absent. Thus it is clear that the drift from the Old Red rocks passed over the outcrop in a W. or S.W. direction, and that the valley influenced the direction of flow. The Gwenddol, which is the valley to the west of Tresglyn, contains very few red sandstone boulders, and these may be ascribed to the Llandovery group and not to the Old Red Sandstone. The drift extends almost to the top of the valley sides, and striated and smoothed pebbles are numerous. All the valleys trending S.S.W. contain drift, and it would seem that the Cwm-dŵr was a main outlet to the iceflow down the more open Towy valley. The general direction of movements appears to have been S.W.

(c) *Country between the Usk and Cwm-dŵr and the escarpment to the South.*

The absence of striæ renders this conclusion as to Cwm-dŵr difficult of proof; but the observations of the Geological Survey authorities in the region immediately to the south, (see Summary of Progress, 1900) support it to some extent. On this point Mr. Strahan says—"It is clear therefore that not only did the ice move westward along the escarpment, and not directly away from it northwards, but that it covered the scarp face to a high level. These facts can be explained on the supposition that a great body of ice was generated in Central Wales."

I have searched the country between the Caermarthen Vans, Cwm Dŵr and Trecastle, and the scanty evidence forthcoming points to a movement towards Cwm Dŵr. The Old Red Sandstone boulders are dragged over the outcrops of the Silurians down to the water's edge at Pentre-bach. In all probability,

therefore, the ice of the region about the sources of the Usk, Sawdde and Gwdderig, joined the main flow from Central Wales.

The evidences of this flow are numerous between Cwm-dŵr and Llandovery, and the drift can be examined in the cuttings along the L. & N.W. Railway.

(d) Country East of the Wye Gorge and the Wye Valley itself below Three Cocks Junction.

Murchison, in "Silurian System," indicates that the Wye Valley near Hereford is covered with fine gravel and silt of glacial origin, and the material becomes coarser when traced in a N.W. direction. He also states that the boulders come from the Old Radnor Hills and along the Wye Valley. He speaks of confused heaps between Dolfan and Builth, and of thick drift between Kingston, Sarnesfield and Hay, and describes how the drift is piled up against the cornstone hills near Hay, opposite the transverse gorge of the Wye. Certainly on the northern slopes of the Wye, in its course from Boughrood to Hay, the Silurian drift overspreads the Old Red Sandstone, and is seen at various places on the south side much higher than can be accounted for by the action of existing streams. Silurian boulders occur sparsely along the Old Red Sandstone drift of the Golden Valley about Dorstone. The escarpment of the Old Red Sandstone to the east of Talgarth rises in two steps, the lowest being about 1,200 to 1,300 feet above sea level, and over three-quarters of a mile wide. The second step rises more abruptly up to heights of 2,000 feet and more. The red boulder clay is full of boulders and pebbles of fossiliferous Silurian rocks, black slates, and sandstones, belonging to rocks of greater age, white vein quartz, and a few small fragments of a dark basic igneous rock. They are generally well smoothed and striated. Though usually not very thick (except in hollows which were probably pre-glacial ravines) the drift covers the lower step, from at least the line of the headwaters of the Monnow almost to Pen-y-genfford, on the Crickhowell to Builth high road, and it extends

down the slope to the Llynfi and the Wye. The foreign boulders, which are not seen in place on the south side of the valley nor nearer than Boughrood, six miles away, on the opposite side were not seen above the 1,300 feet contour line. It is interesting to note that pebbles of exactly the same type occur in the Great Doward Caves near Symonds Yat. It may safely be inferred that the Wye Valley was filled up with ice to a height of nearly 1,000 feet above the present river. As far as present evidence goes, none of the Wye drift passed over the Black Forest escarpment between the Golden Valley and the Rhiangoll (Plate I., Figs. 2 & 3).

(e) Country adjoining the Usk Gorge and the Llynfi Valley.

Though it is clear that the main flow passed along the Wye evidence is forthcoming of a side flow to the west.

"Dinas Castell" stands on a hill between two passes leading from the Llynfi to the Rhiangoll Valley, the highest points of which are 1,050 feet above Ordnance datum. Though no Silurian boulders were found near these gaps in the escarpment, they occur in the valleys on the south side in fair abundance, proving that the Wye drift overflowed into the Usk watersheds at these points.

Though much less abundant, fragments of similar fossiliferous sandstones and shales are found in the fields (about 950 feet above sea-level) on the spur which connects Mynydd Troed eastwards with Llandefaelog-trêr-graig, and the drift containing similar boulders with other foreign rocks, striated, and some smoothed and polished, may also be examined in a small cutting on the Cambrian Railway, at the top of the incline north of Talyllyn Junction. The whole of this district is composed of non-fossiliferous (excepting a few rare remains of fish and crustaceans) Old Red Sandstone; hence the presence of fossiliferous pebbles in the drift, here as elsewhere, is of the greatest value as evidence of direction. Again, on a newly-exposed surface of rock at a quarry near Neuadd, by Llanvihangel-Talyllyn, grooves were laid bare running approximately W. to E. It is probable that

glacial deposits are in part responsible for the formation of Llangorse Lake close by. (See C.N.S. Trans., vol. xxxii.) I have searched the valley of the Llynfi above the lake, but find no drift preserved there. In the fields, however, between Allt Esgair and Talyllyn Station, and above the tunnel, a few small pebbles of Silurian rocks were found.

I conclude, therefore, that the iceflow, influenced as regards direction by the Wye Valley in part, moved along the Llynfi and overflowed the watershed into the Usk Valley down the Rhiangoll, near Talyllyn Station, and probably by the Bwlch.

As stated previously, the ice from the Brecknock Beacons and Caermarthen Vans mostly passed down the valleys of the coalfield. At the same time, there is some evidence of movement in other directions. Thus the two pools of the Caermarthen Vans are supported by glacial debris from the escarpment to the south and west. In the Cray Valley, while the debris is not considerable, it seems to be truly glacial, and the pool Llechyd, to the east of Defynnock, is also supported, in a hollow near the top of the hill, by a glacial barrier. In Cwm Llŵch, at the head of a tributary stream to the Tarell, mounds of coarse drift from Pen-y-fan are numerous, and the Beacon Pool is held up by one of them. Similar mounds occur at the heads of most of the tributary streams in this region. In reference to these, Mr. Strahan (Report of Geological Survey Progress) says—"The material composing these ridges is purely local and angular, and but for its position might be attributed to talus. The material, however, now falling tends to fill up the hollows enclosed by the ridges, and thus to obliterate them. The ridges are frequently compound, and generally crescent-shaped in cwms, but more or less rectilinear under straight precipices. This form indicates that they are the moraines of diminutive glaciers, but whether they came into existence after or during the existence of the icesheet there is nothing to show." While this is probably the explanation of the mounds supporting the pools, it is reasonable to suppose that

while the ice moving down the slopes to the north filled the Usk Valley about Brecon, tributary streams started on the Beacons ridge and joined the main flow before it reached the gorge near Talybont. On an escarpment face, in the absence of boulders foreign to the district, it is always difficult to distinguish between recent rock-waste and glacial deposits. The presence, however, of conglomerate boulders, best matched in the bed exposed on the Beacons ridge, behind Slwch Tump, Brecon, and near Llechfaen, both on the north side of the Usk, can be best explained by flows from the south or south-west. The overflow from the Llynfi near Tallylyn to the same ice stream has been already described. The drift in the gorge below Talybont contains a few Silurian pebbles, but is mostly of the Old Red Sandstone origin.

The Black Forest of Brecon and Monmouth.

Along the same line of escarpment as the Beacons, other iceflows seem to have originated near the Black Mountains between Brecon and Hereford. From this upland the ice certainly followed the direction of the valleys southwards. The upper portions of the valleys show comparatively few undoubted indications of ice action, probably owing to the streams having cleared out their old courses. The rocks are not good for retaining striæ, and it is impossible to distinguish between the results of recent denudation and the accumulations of ice.

Mounds and deposits of sandy clay, with few stones, appear in the upper courses of most of the streams. On both sides of the Rhiangoll Valley boulders containing fossils occur abundantly above Cwm-du, and include yellowish fossiliferous sandstones, dense dark-coloured fine-grained sandstones, and striated Old Red Sandstone pebbles. These gradually get smaller in size and number, and I found a few small but unmistakeable pebbles only near Tretower. I have seen no Silurian rocks in the valleys of the Grwyne and Honddu, hence my conclusion that the northern scarp was too high for the Wye drift to cross. Below Crickhowell, as far as I am

aware, all traces of Silurian drift disappear. The Geological Survey indicates that from Llangundr to Abergavenny "the Carboniferous Limestone formed an insuperable barrier to the iceflow of the Usk Valley," and that gravels, including boulder clay, spread from the Usk up all the tributary valleys to the north, especially near Llanbedr. In Afon Cybi, one of the streams draining the Sugar-loaf, there are a number of mounds probably of morainic origin. Thus, as indicated by Mr. Strahan, the Usk drift includes portions derived from a comparatively distant northern source, and portions derived from the Old Red Sandstone and from the Carboniferous Limestone and Coal-measures on the south side.

CONCLUSION.

The range of mountains, from Hay to the source of the Tawe on the west, formed an impassable barrier to the ice pushed southwards from Central Wales except at one point—where the escarpment is broken by the Usk gorge and the adjoining passes of the Bwlch and Dinas Castle.

The drift of the region south of these hills was derived either from the Beacons Range or from the uplands in the northern portions of the coalfield.




Similarly the range of low hills west of Builth appears to have been sufficiently high to prevent ice from crossing, except at certain points between the valley of the Wye and those valleys which adjoin and are drained by tributaries of the Towy.

The ice from these hills escaped down the dip-slope and, finding it impossible to override the range of the Beacons, turned chiefly along the Wye Valley, but partly through the Usk gorge, and partly to the west to join the Towy flow.

It will be clear, therefore, that the main physical features are pre-glacial in their origin, and that they formed the principal factor in determining the distribution of the drift.

To my relative, Mr. John James, in whose company most of my journeys were taken, I am greatly indebted. Two heads are always better than one; and his keen sight brought about the record of many boulders which otherwise would have been overlooked.

FIG. 1

- | | | |
|---|---|----------|
|  | 3 | GLACIAL |
|  | 2 | KEUPER |
|  | 1 | SILURIAN |

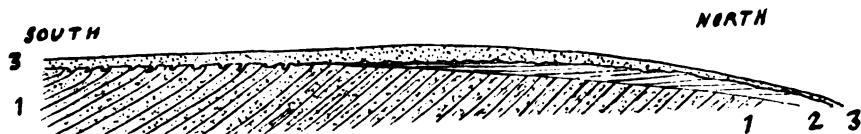


FIG. 2

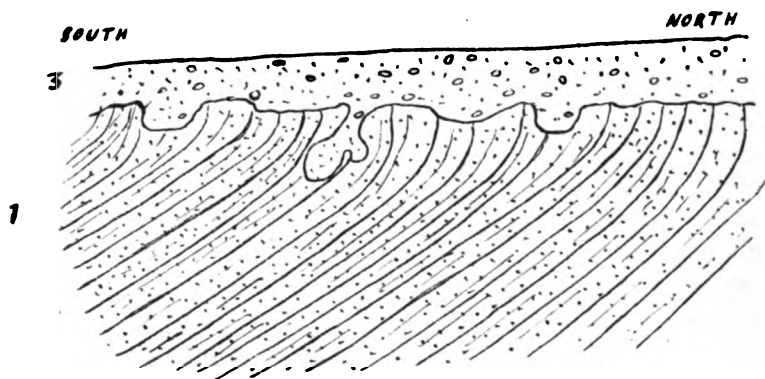
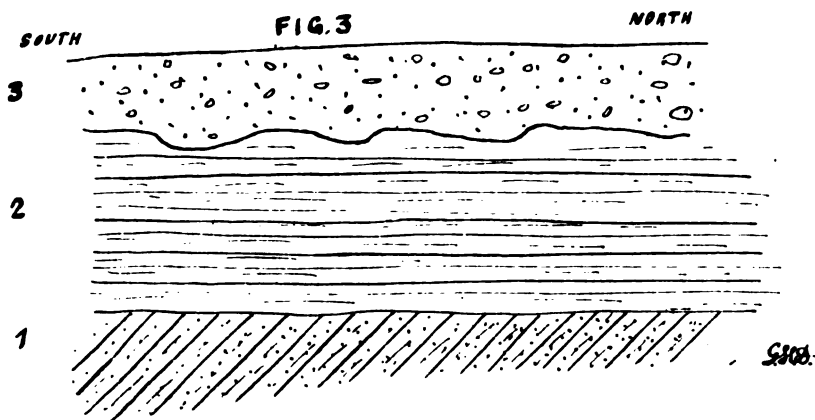


FIG. 3



NOTES ON GLACIAL AND ALLUVIAL DEPOSITS NEAR CARDIFF.

By G. H. DUTTON, B.Sc., F.G.S.

(READ BEFORE THE BIOLOGICAL AND GEOLOGICAL SECTION,
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GLACIAL DEPOSITS.

During the construction of a new line of the Cardiff Railway from Cardiff to Taffs Well in 1899-1900, two cuttings were made which yielded interesting sections of glacial beds. The line runs side by side with the Rhymney Railway from Cardiff to a point nearly due west of the north end of the Roath Park Lake. Here two bridges cross the line about 100 yards apart, and just beyond the south bridge the new railway diverges westward, after passing through sidings in which the first or Heath cutting is seen. Following the railway onwards, it is found to curve round the northern margin of the Heath Estate, and, after running due west for two miles, it passes under the Merthyr Road Bridge, just north of the new asylum excavations at Velindre, near Whitchurch. At this point a large cutting begins, which is about half-a-mile long, and shows a fine section of glacial beds. Beyond the cutting the line crosses the Glamorganshire Canal, and ends off abruptly on an embankment.

HEATH CUTTING.

The cutting extends from the south bridge, a distance of 500 yards, towards the north bridge, which carries the Llanishen Road.

While the face of the cutting was clear, the section as shown in Fig. 1 was seen. For the first 200 yards from the south end glacial gravel rested on inclined Silurian mudstones, as in Fig. 2; then red marls appeared as a thin sheet between these formations, lying horizontally and unconformably on the older rocks, and gradually thickening northwards.

Section at 150 yards from the south end of the cutting, Fig. 2:—

Yellow, sandy glacial gravel, 3 feet.

Red Silurian mudstones, dipping 35° S., with out-crops bent over.

Section at 300 yards from the south end of the cutting, Fig. 3:—

Yellow, sandy glacial gravel, 5 feet.

Dark-red, friable, sandy marls of Keuper age, lying horizontally, with surface contorted, 8 feet.

Dark-red Silurian mudstones, dipping 40° S.

On the Geological Survey map, published before the cutting was started, the Silurians only are shown here. The Keuper marls, however, are noted in the recently published Memoir by Messrs. Strahan & Cantrill.*

The presence of the marls explains the red colouration of the underlying Silurians as being due to infiltration; water falling on the surface and finding its way down to the older rocks through the red rocks, carried the colour in solution.

A detailed examination of the entire section revealed the following facts. The line of contact of the glacial material with the underlying rock was very difficult to trace. Everywhere along the cutting much disturbance of the surfaces of the Silurian and Keuper beds was clearly seen. The soft Silurian mudstones were bent over in a southward direction, their out-crops being drawn out and jumbled up with the sandy gravel, which in many places had pushed between successive beds and formed pockets of sand and small stones. The surface of the

* The Geology of the South Wales Coalfields, part iii. The Country around Cardiff. By A. Strahan & T. C. Cantrill. 1902. p. 42.

Keuper marls had assumed a wavy appearance, and here also was much admixture with the gravel.

The glacial deposit itself was composed of—(1) rounded stones and flints in the following approximate proportions: Millstone Grit, 60 per cent.; milky quartz, 20 per cent.; Old Red Sandstone, 5 per cent.; Pennant Sandstone, 2 per cent.; flints, 13 per cent. (2) 6 rounded boulders scattered throughout the cutting, averaging 2 feet in diameter; four of Millstone Grit, one of Pennant, and one of vein quartz. (3) fine yellow sand.

Many of the stones had smoothed and flattened surfaces, and a few of the Pennant blocks showed rough glacial striations.

The abundant flints, occurring chiefly in small yellow fragments, bear a remarkable resemblance to chalk-flints; some of the larger fragments have retained the black colour in the interior.

The vein quartz boulder and fragments were probably brought from distant localities. The milky quartz was no doubt derived from the attrition and disintegration of travelled boulders and stones of Old Red Sandstone and Millstone Grit.

The most interesting feature in the exposure was, however, the bending over and contortion of the Silurian and Keuper beds. This condition we may suppose to have been brought about by a great mass of ground ice flowing towards the south, and dragging the surface rocks slightly forwards in that direction.

WHITCHURCH CUTTING.

This cutting is about half-a-mile long, and has a maximum depth of 70 feet. Taking a general view of the country through which it passes, the whole area for a radius of about 500 yards from the middle of the cutting is seen to have the hummocky, mound and hollow appearance, characteristic of local glacial deposits, and well seen at Pendoylan, St. Lythans, Radyr golf-course, and Llanishen. One of the hollows to the north of the

cutting, near Coryton House, is of unusually symmetrical form, and contains a pool of water. Turning to the section in the cutting, it is therefore not surprising to find there a deep section of glacial beds. From top to bottom all is one mass of rounded and flattened stones, packed together in a grey sandy matrix.

During the excavation, no rock-in-place was exposed at any point in the section.

By careful examination, the composition of the glacial material was found to be as follows:—(1) Striated, flattened and rounded stones, in the following approximate proportions—Pennant Grit and Coal Measure Sandstone, 60 per cent.; Millstone Grit, 25 per cent.; and Old Red Sandstone, 10 per cent.; Carboniferous Limestone, 5 per cent. (2) 15 boulders, varying in size from two feet cube to five feet cube, as follows—

8 of Carboniferous Limestone, 5 of which were subangular and 3 scratched and rounded.

5 of Millstone Grit, 4 subangular and 1 rounded;

1 of Pennant Grit, rounded;

1 of Coal Measure Sandstone, angular block.

A comparison of the Limestone boulders with local rocks has revealed a great similarity to the Carboniferous Limestone of the Castell Coch and Little Garth neighbourhood. Taking this fact, together with the subangular character of the large majority of the boulders, it seems fairly certain that the latter were directly derived from the rocks of the Taff Gorge at Walnut Tree.

The included stones were mixed up together, and generally presented no definite arrangement, except towards the top of the cutting where they lay with their flattened surfaces more or less horizontal. At one place at the top, a layer of sand with fine fragments of coal appeared just below the surface. Assuming that these deposits form part of the terminal moraine of the Taff glacier, these attempts at stratification might be easily accounted for by a stream resulting from the thawing of the ice.

In comparing the glacial beds of the two exposures, the total absence of flints in the Whitchurch cutting is noteworthy. The evidences of glacial action obtained in both cuttings point to a southward flow of ice. The flints and also the large fragments and boulder of vein quartz of the Heath cutting perhaps indicate another movement of ice in a different direction.*

ALLUVIAL DEPOSITS AT ROATH.

Excavations for the Electric Power Station on the Newport Road, by the side of Roath Brook, in 1901, yielded the following section :—

Height of surface above Ordnance datum, 23 feet.

	Feet.	Inches.
5. Blue estuarine clay, thickness varying from	18 to 28	0
4. Peaty clay, with twigs of hawthorn and hazel, hazel nuts, and <i>Limnœa</i> shells	0	4
3. Clay	0	6
2. Fine gravel	0	6
1. Shingle, large rounded pebbles, with many bones, fragments of wood, and two large trunks of oak ...		

The foundations of the building were laid upon the bed of shingle. No rock-in-place was reached.

The following bones were found in bed 1, nearly all being taken out from within a radius of 10 yards at the north end of the excavations :—

Urus (*Bos taurus* var. *primigenius*)—one perfect pair of horn-cores with frontals, and another pair in fragments; pelvic bones.

Celtic short-horn (*B. taurus* var. *longifrons*)—fragments of four pairs of horn-cores, two lower jaws, pelvic bones and limb bones.

* See "Notes on Ice-action in South Wales," by Messrs. F. T. Howard and E. W. Small. C.N.S., Trans. vol. xxxii., p. 44.

Red deer (*Cervus elephas*)—metatarsal bone.

Pig—skull, lower jaw, and limb-bone.

Goat—two lower jaws of a young animal.

(?) Goat—limb-bones.

Human femur and calvarium.

The above bones were identified by Mr. E. T. Newton, F.R.S., of the Geological Survey, who considers that the entire series has a comparatively modern aspect notwithstanding the presence of *Urus*, which became extinct in late Neolithic times.

Two large trunks of oak, with roots, each about 20 feet long and 4 feet thick, were found lying horizontally in the gravel beds. Many other fragments of wood, including alder, elm, hawthorn, and fir, were found in the same deposits. These, and the logs, with no doubt also the bones, were probably washed down by a stream and stranded in the marsh, whose former presence is shown by the clayey peat-bed with shells.

It may be of interest to compare this section with the beds noted by the late Mr. John Storrie, at the Roath Dock in 1886, which were as follows:—

					Feet.	Inches.
Estuarine silt or clay	...	...	...	...	5	6
Reed bed	...	...	...	...	0	3
Estuarine silt, trunks of oak and willow						
towards the bottom	...	...	...	...	7	6
Reedy band	...	...	...	...	0	9
Clay, with trunks of willow...			...	...	2	0
Reed bed	...	...	...	...	0	3
Clay	...	...	...	...	1	0
Gravel	...	...	...	...	10 to 12	0
Keuper marl	...	...	...	...	—	—

Practically the only point of difference is that while at the Dock, marsh-conditions, involving the deposition of reeds, &c., obtained at three stages during the subsidence, at the Power Station only one peat-bed occurs. The latter was probably contemporaneous with the lowest of the reed beds. The continuous deposition of the estuarine clay was probably

due to a local depression in the old land surface ; this probability is strengthened by the fact that the thickness of clay varied from 18 feet at the north and south ends of the excavations to 28 feet in the centre.

The find of the horn-cores of Urus was fortunate ; for, though fragments of the same have been recorded from alluvial beds at Roath, Barry and Newport Docks, this is the first example of a pair so perfectly preserved. Bones of the Celtic short-horn and red deer, and antlers of the latter, were obtained in large numbers by Mr. Storrie at the above docks from contemporaneous deposits. When the bones were first brought to light at the Power Station, Mr. Storrie, ever watchful in the interests of local Geology, at once visited the site, and it was due to his prompt action, in which he was ably assisted by Mr. Irwin, Clerk of the Works, that the remains were brought to the surface in good condition.

All the objects here referred to, with specimens of the glacial boulders and stones, are placed in the collections of the Welsh Museum, Cardiff.

SOME REASONS FOR BELIEVING THAT BARRY AND SULLY GAVE NAMES TO THEIR LORDS' FAMILIES RATHER THAN THE LORDS TO THE PLACES.

J. S. CORBETT.

As to Barry, Giraldus Cambrensis was born about the middle of the twelfth century, not more than 60 or 70 years after the conquest of Glamorgan, and was himself of the de Barri family.

In his *Itinerarum Cambriæ*, after speaking of Cardiff, he says :—

“ There is, not far distant from hence, a small island situated on the shore of the Severn sea, which the neighbouring people (call) Barri, so called from the name of *Saint Baroc, formerly an inhabitant of the same place ; whose remains also, removed into a tomb, are contained in a chapel there situate, embraced in the folds of ivy. *From the name of this island*, too, the nobles of the parts of South Wales, bordering on the sea, who are want to bear rule over the same island, with the neighbouring lands, *are named*. Taking, that is to say, first, the agnomen, then the cognomen of de Barri, from Barri.”

I think “ agnomen ” and “ cognomen ” are not quite translatable, at least, by one word.

Agnomen, I believe, is a name applied to [†]one man. Cognomen is used when it has become applicable to many, *i.e.*, a surname of a family.

*Whether this was really the origin of the name of the island is not so clear.

† *i.e.*, as an addition to distinguish him from others of the same Christian name.

This would just apply to the case of the first Lord getting to be called de Barri. It would be his "agnomen." Then, when his sons and their descendants continued to be called by it, it would be their "cognomen."

Can we think that Giraldus de Barri was mistaken about this?

Then he is not without confirmation. Walter Mapes, a contemporary of Giraldus, writes in his "*Cambriæ Epitome*":—

"Likewise in South Wales at Cardiff, there is an island near the Severn sea, called *of old time Barri*."

This does not look as if *he* thought it had lately acquired that name from the Lords.

As to Sully, there is the case of a family, or, at all events, some members of it, interested apparently, in the *Scilley* Islands, and thence called "de Sully." I do not think there is any reason to suppose they were connected with the Glamorgan Sullys, or derived their name in any other way than from connection with Scilley.

It is a curious fact that Leland spells the name of our Sully in that way, and it is so pronounced by the Welsh.

Camden says, "which tooke the name, as is thought, of Robert Sully (for it fell to his part in the division) *if you would not rather have him to take his name of it.*"

On the map in Camden the name is "Sylve."

The de Sully who had to do with Scilley, near Cornwall, had nothing to do with Sully in Glamorganshire, and as his name of de Sully was evidently derived from that place, why should the reverse be supposed to have happened here, being the reverse also, of what clearly took place in the adjoining parish.

SOME RHONDDA CAIRNS.

BY REV. JOHN GRIFFITH, OF NANTYMOEL.

Author of "Edward II. in Glamorgan."

The following remarks are intended to serve as explanations of the accompanying illustrations, rather than as a full report of last year's field work done by Members of the Rhondda Naturalists' Society.

It is, however, of importance to note the position of a group of cairns which, as far as my information extends, have not been marked, either singly or collectively, on any map. They are five in number, erected on the flat of the mountain ridge which divides the Rhondda from the Ogmore Valley. It would be convenient to note them as the *Mynydd y Ton* Cairns, though the Ogmore side of the mountain flat is called also *Mynydd William Meyrick*. The latter name may be that of an Abbot of Margam. At any rate the following facts are worth noting. If the reader will look at Sheet 248 of the *Geological Survey Map* (Pontypridd), and note the position of the letter "k" in the name *Meyrick*, he would find in a bog near a pool at that spot a rather ancient-looking boundary stone, showing about a foot square above ground, with the name *Margam* inscribed on it. I mentioned this to Major Gray, of Port Talbot, who kindly supplied me with the name of the Margam Abbot. It is further worthy of note that certain charters give to the Monks of Margam certain rights to land on the south-west side of the Rhondda Valley.

On the map-sheet mentioned a pyramidal mark stands for a round tower, some three feet high, erected by surveyors, and

close to the mark are the figures "1769," the highest point on *Mynydd y Ton*, with the precipice, *Craig y Geifr*, the Goat's Rock, close to it on the north-west. The surveyors who built the stone tower did not mark the site as that of a cairn. That it is so is indicated by its round form and its circle of stone slabs, not upright, but fixed at an angle roughly of forty-five degrees. This I propose to call Cairn No. 1 (Ton).

In the summer of 1901, I conducted Col. Morgan and Mr. Glascodine, of Swansea, to three of the Ton Cairns. When I conducted another party to the spot, the surveyors' stone tower was found demolished on Cairn No. 1, and a hole some 18 inches deep had been made into the centre of the cairn. The cairn is 27 feet diameter, rising about three feet above the present surrounding surface. It has a thick coating of grass-covered peat. On opening it last summer clear indications were found of the cairn having been previously opened and the kist destroyed. Nothing of further interest was found in it.

The whole group of cairns are peat-covered, and this, perhaps, is the reason why the mapsters overlooked them.

Cairn No. 1 is situate on the highest point on the Ogmore side of *Mynydd y Ton*. Cairn No. 2 is situate on the highest point on the Ton side of the flat, a slight marshy hollow separating the cairns. I have made out the distance (by pacing) between them to be 185 yards. The two cairns make a straight line with Ystrad Station. Cairn No. 2 is so deeply covered with grass and peat that not a single stone marks the outer circle. By prodding with a stick, I found the peat covering to be from six inches to 18 inches deep all over the cairn. The grassy mound, as it is now, is nearly circular, 31 feet diameter one way and 29 feet the other way, rising between two and three feet above the surrounding surface.

On opening this cairn last summer a kist was found near the centre. The slabs were somewhat worn, and the kist altogether was smaller than our average Rhondda kists (and we have now found many). The position of the slabs resting on and

supporting the kist showed that the latter had not been disturbed. But upon taking off the capstone, the kist was found full of water. A trench was dug in the side of the cairn to let the water out, when on the bottom slab absolutely nothing was found except a coating of mud.

While the workmen were clearing a space round the spot where the slanting slabs clearly pointed out a kist to be under their protection, Mr. Robert Lewis, B.A., son of Canon Lewis, noted a spear-shaped stone sticking on end in the peat, right close to a corner of the kist. (Plates I. and II., Fig. 2.) All who were present noted both the suggestive position of the stone and its evident suitability for a sort of weapon. It is about 16 inches long. It was sent with other finds to Professor Boyd Dawkins, and Mr. W. Parfitt, Hon. Secretary of the Rhondda Naturalists' Society, received the following letter from the Professor :—

“THE OWENS COLLEGE,

MANCHESTER,

2nd December, 1903.

DEAR SIR,

The specimen which you sent is an artificially formed flake of sandstone, which has, like similar objects found in Ireland, probably been used as a club. From its position in the peat tumulus, it was evidently intended to mark the burial place.

It may belong, like the Irish specimens, to the Neolithic Age.

I am so much interested in it that I have had a cast taken of it for the Manchester Museum—I suppose that you will keep the original.

You should record the find in some Archæological Journal, and send me a copy.

I am, dear Sir,

Yours truly,

W. BOYD DAWKINS.

W. PARFITT, ESQ.”

I have since found a stone at *Bwlch y Clawdd* (Plates I. and II., Fig. 1,) the Gap of the Dyke, close by, which seems to be of the same type, which for purposes of comparison, at any rate, should be figured with the specimen from Cairn No. 2. The former has evidently been somewhat damaged; the notch at the back of the cleaver-shaped stone seems to be accidental and recent. A piece of the part that looks like a handle seems to have been recently cut off, as well as the semi-circular notch that gives that part the appearance of a handle. I have found several other worked stones at *Bwlch y Clawdd*. The stone axe (Plates I. and II., Fig. 3) I picked up on the bridle-path between *Bwlch y Clawdd* and *Nantymoel*. Following the course of this path, but in a more zig-zag fashion, is a much older one. It should be noted that the three objects figured together are of local sandstone. The fact having been established, I believe, that tools and weapons have been fashioned of such material, I have made a diligent search in the same locality for all sorts of worked stones. Many of the specimens I have found range themselves into well-defined series, into three series at least, the uses of the tools I cannot make out.

A distance of 81 yards or paces from Cairn No. 2 is situate a round mound, which I propose to call Cairn No. 3, which, with Cairn No. 2 and Maindy Camp makes a straight line. It is nearly circular, 21 feet diameter one way and 23 feet the other. Here the peat is deeper than in the adjoining cairns. We began digging a trench at one point, but found so much peat that it was decided to abandon the digging. By prodding, I have found the stone slabs underneath, and I am inclined to regard this cairn as genuine as any of our peat cairns. The mound rises above the surrounding surface some 18 inches.

Near the edge of *Craig y Geifr*, making a straight line with Cairn No. 1, and the nose of the headland above *Nantymoel*, called *Braich y Rhydd*, is situate Cairn No. 4, 16 feet diameter, surrounded by a shallow ditch and thickly covered with peaty earth. A depression of six feet diameter in the centre suggests that the kist has been destroyed.

Nearly half-way between Garn Fawr and Cairn No. 1, and almost in line is situate Cairn No. 5, which completes a group of peat cairns on *Mynydd y Ton*. This cairn I have not visited since 1901, and I neglected then to note exactly its position and dimensions. This group of five cairns occupy the same mountain flat, bounded on the north-west by Bwlch y Clawdd, and on the south-west by Garn Fawr, one of our largest shell-cairns, so to speak, for it is very much destroyed. The group (dominated by Garn Fawr) seems to me, by its position, to mark the site of an ancient village, the actual abodes of the inhabitants I find, as I think, in the numerous round holes and rude stone hut-circles sheltered by the adjoining precipices on both sides of the mountain ridge. On the adjoining Gelli-Llwynypia headland, I have made out three such groups of cairns, not a single cairn marked on the maps, with rocky precipices capable of shelter and defence close to each group. The headland, which extends from Bwlch y Clawdd to the Maindy Camp, is called *Mynydd y Maendy*. Three cairns on this headland are now known to us, though only one of the three has been noted by the mapsters. Altogether, here are seven cairns close to each other, four of which have proved by actual excavation to be true cairns, and the rest not yet proved not to be cairns, which await recognition in our maps.

Last summer we excavated *Crug yr Avan*, which is situate between the source of the River Avan and Cwmpark. In an article descriptive of the outward appearance of this mound, which was published in the *Arch. Camb.* for April, 1902, with an accompanying illustration, I could not help characterising it as "Glamorgan's Lone Sentry-box." The mound is 61 feet diameter, and from eight to nine feet high. We commenced digging into a crater-like hole on the top near the centre of the cairn, and we worked right down to the sub-soil. We concluded from the haphazard position of the stone slabs we encountered at that spot, that others had been excavating the same spot. Despairing not, we worked southward to the spot where the mound was highest, and a little south of the centre

of the mound we came across a fine kist. Hemming in the kist, and resting against the capstone at an angle of 45 degrees or so, were heavy slabs. We had to clear a large space in order to extricate these protecting slabs. In doing so we had to dig through several feet of sand and peat, the sand apparently being disintegrated or decomposed sandstone. It took the combined efforts of the four workmen to lift the capstone, which varied in thickness from five to eight inches. The accompanying photograph shows the capstone standing on end (Plate III.). On the lower left hand corner the photograph discloses a marked resemblance to a man's face. No one noted this *lusus naturæ* on the capstone itself. The left hand slab of the kist proper shows rather faint in the photograph. The space on the right of the kist looks like a part of another kist, though we were not able to prove it to have been such. The bottom slab of the kist is partly shown, slightly raised at the back. It was found unevenly resting on smaller stones, forming a "false bottom."

In lifting the capstone, a layer of the inner side of that stone was found detached and fallen into the kist. Perhaps the piece got detached during the attempt to lift the stone. When the fragment was taken out of the kist, something like a black and white wreath, of some 15 inches diameter, appeared on the bottom slab. The whiteness was given to the wreath by small bones, the blackness by some sticky substance. This substance, I wish to note, looked distinctly blackish as first observed in the kist. But when scraped out and afterwards examined, it was more brown than black, bark-coloured in fact, and seemed to be largely bark.

Unfortunately, before we could set about scraping together the contents of the kist, some of the sandy stuff, already mentioned, fell from the side above into the kist, nearly covering the whole of the remains. All we could do now was to gather everything in the kist, sand and all, for preservation and examination. It took a large part of a day to sift the bucketful of stuff we brought down to Ton from the kist.

There were some hundreds of small pieces of calcined bones. The only things besides the bones and the sticky substance in which they were embedded, that appeared to have archæological value, were two pieces of what appeared to be some sort of dagger or spear-head. Four lines alongside of the centre ridge form actually an ornamentation on a bronze dagger, Figure 32 in Lord Avebury's "Prehistoric Times," opposite page 31 (1900). I cannot help attaching some significance to this resemblance, in view of the ascertained fact that savage races sometimes bury imitations of weapons with their dead in lieu of the real articles.

The contents of the kist, *minus* sand and dirt, were sent to Professor Boyd Dawkins, who has kindly forwarded to our Secretary his opinion about them:—

"THE OWENS COLLEGE,

MANCHESTER,

7th December, 1903.

DEAR SIR,

The specimen found in the cairn is the last segment of the tail (= telsar) of a fossil crustacean, closely allied to the Pterygotus, which is found in the Upper Silurian and Old Red Rocks of Radnor, Salop, and Herefordshire. (Plate IV., Figs. 1, 2.) It may have been used as an arrowhead or javelin head. It has undoubtedly been collected, and placed with the ashes of the dead, who may have had a geological collection.

In the box are calcined teeth and fragments of bone in the usual condition of those found in funeral urns.

The collection is from a burial place, probably of the Bronze Age, in which the body was burnt and the ashes carefully placed in an urn, which has crumbled away.

The whole discovery is full of interest.

I am, dear Sir,

Yours truly,

W. BOYD DAWKINS.

W. PARFITT, ESQ."

PLATE I.

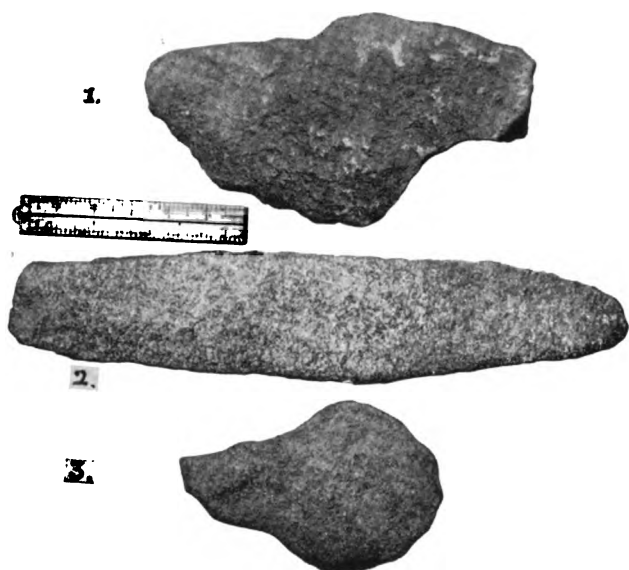
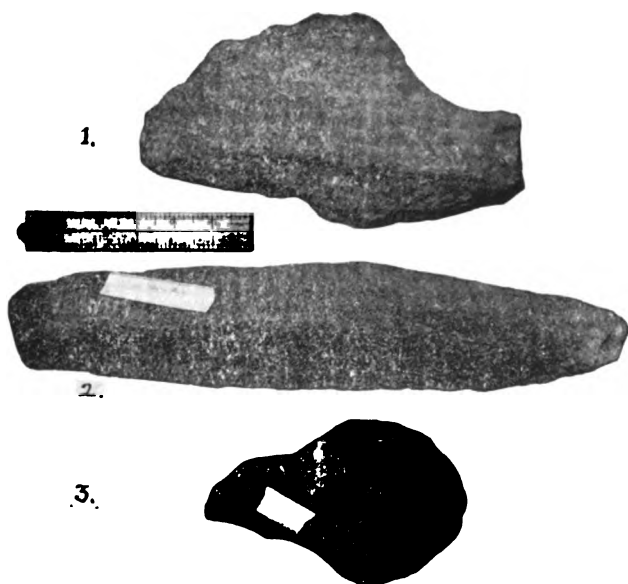
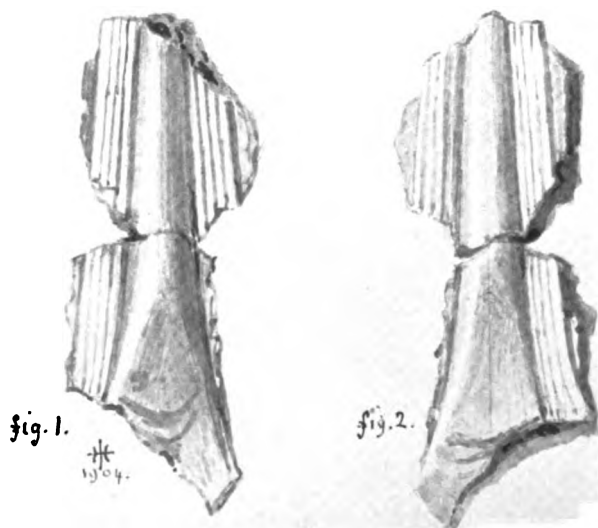


PLATE II.





CIST IN CRUG YR AVAN.



SEGMENT OF TAIL OF FOSSIL CRUSTACEAN (OLD RED SANDSTONE OR SILURIAN)
FOUND WITH HUMAN REMAINS IN CRUG YR AVAN CIST.

The above is only a part of the report of the last season's excavation work in the Rhondda, the third season's work of the Rhondda Naturalists' Society. I wish to add that in all our work we were guided and superintended by Mr. H. W. Williams, F.G.S., Solva, Pem. Of the members of the Society who assisted in the work last season, special mention must be made of Canon Lewis, first President of the Society; Mr. Llewelyn Jones, Principal of the Higher Grade School, who was then President; Mr. W. Parfitt, Headmaster of Gelli Schools, our energetic Secretary; Mr. Dan Thomas, Pentre; and Mr. William Griffith. We were very much assisted by some Rhonddaïtes on their holidays, such as Mr. Robert Lewis, B.A., Mr. Stephen Jones, B.Sc., and Mr. W. J. Davies, the last two from London, who, between them, managed the difficult task of photographing the Crug yr Avan Kist. According to his rule, we had again the pleasure of welcoming Col. Morgan, of Swansea, as representative of the "Cambrians." At Crug yr Avan, we were visited by the Rev. J. Jones, Vicar of Llangeinor, and the Misses Jones; Mr. Alfred Griffiths, University College, Cardiff; and Mr. Dan Griffith, Bowes Park, London.

ORNITHOLOGICAL NOTES

FOR 1902 AND 1903.

BY T. W. PROGER AND D. R. PATERSON.

Red-footed Falcon. *Falco vespertinus*. A specimen was shot on June 1st, 1903, by the keeper at St. Fagans near the pheasant coops. It was a male in full plumage. Another bird, probably the female, was observed near the same place shortly afterwards. This species is sometimes misnamed the Orange-legged Hobby, though it is more nearly akin to the Kestrel. According to Howard Saunders, it is merely a summer-visitor to Europe. Its appearance in the British Isles was first noticed in 1830, and subsequently about thirty specimens have been obtained. It has occurred in Pembrokeshire and Denbighshire. Most of the authenticated occurrences have been in spring or summer, with a few in autumn, and exceptional instances in the winter months. The Red-footed Falcon breeds in Silesia and in the Danubian provinces and Hungary; westward it is only a straggler. Its food consists chiefly of insects and of lizards and field-mice. Its flight resembles that of a Kestrel, and it usually seeks its prey in the evening.

Great Bustard. *Otis tarda*. A perfect specimen of this rare bird was shot December 20th, 1902, by a farmer near Pontardawe, who thought it was a wild goose. This bird is now preserved and in the possession of Mr. Arthur Gilbertson, Glanrhyd, Pontardawe. It was exhibited for a short time in the Welsh Museum, Cardiff. This fine species formerly bred in this country, and formed a striking object in the landscape; but the enclosure of waste land and the increase in the population led to its gradual passing away. The eggs were last taken

in Norfolk and Suffolk in 1838, and now the bird is only an irregular wanderer to Great Britain. In the winter of 1870-71 a considerable number arrived in this country, and a smaller number in 1890-91. It is resident in Germany and Spain, where it breeds in large numbers. Efforts have been made lately by a large landowner in the Eastern counties to re-introduce the Great Bustard into this country, but it is too early yet to say with what success.

Waxwing. *Ampelis garrulus*. A specimen of this beautiful bird was seen on the golf-links at Porthcawl early in November, 1903. It was very tame, and fluttered about within five or six yards of Mr. John Nicholl, Merthyr Mawr, who made the observation. It had evidently just arrived; the weather had been very stormy shortly before. This bird, which is an inhabitant of the Arctic regions, visits this country at irregular intervals, and its appearance depends on the severity of the weather on the continent. Most of the specimens have been met with on the eastern side, but it has occurred in almost every county. That it should occur on the south and south-west coast is what one would expect, as the east-to-west migration from the continent to this country in severe weather as proved by the investigation of the British Association's Committee, finds its way along this coast, and explains the occasional record of this bird in South Wales.

Glaucous Gull. *Larus glaucus*. A specimen of this rare Gull was shot on February 4th, 1903, on the East Moors, Cardiff, by a fisherman. It was an immature female. It is now preserved and in the possession of Mr. Walters, Conway Road, Cardiff. The only record of this species in the county is an immature specimen shot in the same neighbourhood eight years ago. (*Birds of Glamorgan*.) This is one of the largest of the gulls, being equal in size to the Great Black-backed, and is a visitor to our islands during the colder months of the year. In severe winters it may be abundant on the coasts, and, as a rule, immature birds form the majority. In Wales and the West of England it is rare.

Glossy Ibis. *Plegadis falcinellus*. For the following interesting note we are indebted to Mr. Percy Laybourne, Caerleon. "On the afternoon of October 11th, 1902, a labourer observed a large bird flying high up over the town of Newport, mobbed by a number of smaller birds, which afterwards proved to be rooks. To escape their attacks the strange bird, which flew like a Heron, dived towards the earth, crossed and re-crossed the Usk, and alighted in a field on the bank. It was thirsty, and drank from a pool. It seemed very tired, and laid down and got up again several times, behaving like a worn-out Carrier Pigeon. It was eventually shot by the man who watched it all the time—about 20 minutes. The bird proved to be the Glossy Ibis, an adult male in winter dress, and having the characteristic metallic lustre on its plumage. About the same time an immature specimen was shot near Stalham, Norfolk, being sooty-black, without, of course, the sheen of the mature bird. In Norfolk, apparently the most favoured place in England of this rare visitor up to last year, only two or three specimens had been obtained since 1833, the last being killed on September 13th, 1868, also in that part of the Broadlands."

MISCELLANEOUS.

SUMMER MIGRANTS. The following appearances were noted in 1902: First Swallow seen on Flemingston Moors, April 4th; Chiff Chaff, on same date in same locality, by Mr. Pole Evans; Red Start at Sant-y-nil, April 11th; Swifts at Roath Park, April 20th; Cuckoo at Rumney, April 17th; Nightingale, April 24th, four were heard singing at Llanmaes. In 1903, Swallows and Sand Martins noted in numbers at Roath Park Lake on April 4th; Cuckoo was heard at Parc, Llanishen, April 20th, and at Southerndown, April 21st.

NESTING. On May 11th, 1903, a Grey Wagtail's nest with young, was found in ivy, on a block of ruined masonry, overhanging waterfall by the old flannel factory at Caerphilly. The Rock Dove was found sitting on October 13th, 1903, on the cliffs near Port Eynon, in Gower, by Mr. Worsley-Benison.

VARIATIONS IN PLUMAGE. An albino Starling was shot at Bedwas by Mr. Williams on July 1st, 1902. The bird had pink eyes and not a single dark feather upon it.

HAWFINCH. One flew against the window of Mr. Pettigrew's house in the Cardiff Castle Gardens, and was caught and turned into the aviary at Victoria Park. This species has again nested in the locality, the young have been seen flying about at Llandaff, and its numbers are certainly increasing. Capt. Traherne noted at Coedyrhydyglyn a pair on March 13th, 1903, and another pair on the 21st, feeding on cedar seeds.

NIGHTINGALE. This bird was noted by Mr. John Nicholl, at Merthyr Mawr, during the summer 1903. He heard it repeatedly for many nights in succession, and it was seen by other observers. This is the most westerly locality hitherto recorded in the County for this species.

LESSER-SPOTTED WOODPECKER. This species was found breeding in a fir tree by Mr. Gilbert Scott, near Nantgarw, on June 8th, 1902. There were four eggs in the nest. A specimen was shot at Castlefield on January 7th, 1903, and it was stated that several Greater Spotted Woodpeckers were shot in the locality about that time.

GREAT GREY SHRIKE. Was observed by Mr. John Nicholl, on the "Golden Mile" between Bridgend and Cowbridge in April, 1902. He has noted the Red-backed Shrike as remarkably plentiful at Merthyr Mawr during summer 1903.

GOOSANDER. A female was shot at Llanishen Reservoir on November 5th, 1902, by W. Marsh.

GREAT NORTHERN DIVER. A bird of the year was shot on the Reservoir at Llanishen by W. Marsh, on November 13th, 1902. A specimen was picked up nearly dead on October 22nd, 1903, on the beach under Penarth Head. It was in a wounded state, and on removing the skin several shot were found in the head and neck.

BITTERN. A specimen was shot on December 8th, 1902, by Mr. Williams, Tela Garw, Pontyclun. It was a very fine male bird. It was being mobbed by Green Plovers, and took refuge in the garden where it was shot.

PEREGRINE FALCON. On July 9th, 1902, a man working in the quarry, at Rhoose, near Barry, saw a large bird dash itself against the face of the rocks and fall to the ground. It was caught, and the bird, which was a female Peregrine in second year's plumage, recovered and lived for a few days, when it was unfortunately killed. It is assumed that the bird was swooping at something, and, suddenly catching sight of the man, it altered its course and met with the accident described. A male bird in first year's plumage was shot on December 21st, 1902, on the East Moors by a local gunner. Two Peregrines were shot on July 26th, 1903, at Llantwit Major by the keeper, a male in full mature and a female in second year's plumage.

COMMON BUZZARD. A specimen was trapped at Pencoed Farm, near St. Fagans, on April 3rd, 1903. Mr. Mounteney records that on July 12th, 1902, he saw a Buzzard soaring over the Llantrisant Road, half-way between that town and Cardiff. It was too high to determine the species.

RICHARDSON'S SKUA. A specimen in immature plumage was shot at Brynmawr, on March 4th, 1903, by Mr. A. Williams.

BLACK TERN. This bird, like the Skua, was in immature plumage, and was shot at Beaufort Hill, Beaufort, on August 25th, 1903. Both were probably driven inland by heavy gales.

CHOUGH. Two Choughs were sent up to Cardiff from Pembrokeshire along with a consignment of rabbits, where they had been caught by the legs in rabbit traps.

NUTHATCH. Hon. Odo Vivian records a specimen being picked up dead on the road near Swansea after the great storm in September, 1903. This bird is so rare in the county, though it is numerous in the neighbouring counties of Brecon and Monmouth, that its occurrence so far to the west is of interest. It may have been blown from Breconshire by the severe gale.

NOTES BY THE LATE REV. H. MORGAN-STRATFORD.

The following notes, taken from the late Rev. H. Morgan-Stratford's copy of Bewick's "Birds," and in his own handwriting are of interest as furnishing some old records in the

county. Some of them have already appeared in the "Birds of Glamorgan."

HOODED CROW. Five were seen in 1884, at St. Athans, and seven in 1885, all in the early spring.

GREAT GREY SHRIKE. Was shot at Bridgend in 1881.

ROUGH-LEGGED BUZZARD. "In 1855 I saw one several times about Llantrythyd Park and also near the Holly Bush Farm east of Cowbridge; about 1879 I saw one in the middle of a large field at Fonmon."

DUSKY GREBE. Shot by Mr. C. R. M. Talbot, at Penrice.

HAWFINCH. One shot on the lawn at St. Athans' Rectory in 1867.

SOLITARY SNIPE. One was seen by me but not shot near Causeway, at Old Mill, near Gileston, in the winter 1870.

GREY LAG GOOSE. "Three have been brought to me at different times shot by gunners in the neighbourhood."

WILD SWAN. Shot on March 4th, 1870, by D. Hopkins, blacksmith, St. Athans, on Tregough Moor.

LITTLE BUSTARD. Shot by John Williams, in the Nine Acres, Gileston, on November 19th, 1885, and picked up on the 21st by Sam Howe on the Nine Acres behind the Cot at Laleston.

LITTLE AUK. "I shot one on January 10th, 1856, at mouth of Thaw."

NOTES BY CAPT. TRAHERNE.

The following records were supplied by Capt. Traherne, Coedyrhydyglyn.

GOLDEN ORIOLE. Was seen at St. Hilary, 1878, and at Coedyrhydyglyn in 1883 and 1886. These birds were in pairs and probably bred there.

QUAIL. Shot at St. Hilary in 1876.

HOOPOE. A single one was seen at St. Hilary in 1877.

With regard to the last species, Mr. F. de Courcy Hamilton notes that he saw one on the 16th May, 1900, in the St. Fagans Fields. It flew towards him, its flight resembling that of a jay. It lit on the ground, and afterwards flew into a tree.

BIOLOGICAL & GEOLOGICAL SECTION.

REPORT FOR THE 16TH SESSION, 1902-3.

COMMITTEE:

The PRESIDENT and HON. SECRETARY of the C.N.S. (*ex-officio*).

T. H. THOMAS, R.C.A., *President*.

A. F. DIXON, Sc.D., M.B.

W. W. PETTIGREW.

A. H. TROW, D.Sc., F.L.S.

J. J. NEALE, } *Hon. Secs. for Field Walks.*

T. W. PROGER, }

W. N. PARKER, Ph.D., *Hon. Sec.*

The number of members on the books is 47. Six ordinary meetings have been held during the Session, with an average attendance of 16.4.

Owing to the change of date of the Annual Meeting to the end instead of at the beginning of the Winter Session, the Report on Field-Walks will be furnished by the Hon. Secretaries at a later date. The Annual Meeting was held on May 21st, 1903.

The following papers were read during the Session:—

October, 24, 1902.

D. R. PATERSON, M.D. (President C.N.S.), "Routes of Bird-migration," illustrated by lantern slides.

November 20.

WENTWORTH H. PRICE, "Mountain-climbing," illustrated by lantern slides and photographs.

December 17.

J. E. CAMPBELL-TAYLOR, "Insects and their Metamorphoses," illustrated by lantern slides.

January 15, 1903.

F. T. HOWARD, M.A., "On the Glaciation of the N. and N.E. portion of the Society's district and region adjoining."

F. T. HOWARD, M.A., and EPHRAIM H. DAVIES, B.Sc., "On the igneous rocks of Llanwrtyd and Llangadock." (In the absence of the author these papers were read by Mr. W. S. BOULTON, B.Sc.)

W. N. PARKER, Notes on Specimens recently received from Messrs. I. B. Pole Evans, J. J. Neale, and Dr. C. T. Vachell (*Cicada septendecim*, *Chimæra monstrosa*, *Scorpæna*, *Scyllium catulus*, and *Moloch horridus*).

February 12.

A. F. DIXON, Sc.D., M.B., Exhibition of Drs. Bryce and Teacher's lantern slides illustrating maturation, fertilization and nuclear division in the sea-urchin. (Owing to Professor Dixon's unavoidable absence, remarks were made upon the above by the Hon. Secretary.)

GILBERT H. DUTTON, B.Sc., F.G.S., "Notes on Glacial and Alluvial Deposits near Cardiff."

E. J. EVATT, M.B., "On the structure of bone," illustrated by specimens and stereoscopic Röntgen-ray photographs.

March 5.

GEORGE HARDING (of Clifton), "On Microscopic Fungi," illustrated by a large number of unique coloured drawings made by Mr. Edwin Wheeler, of Clifton, and representing both microscopic and macroscopic forms. A number of Mr. Wheeler's exquisite coloured drawings of fishes were also exhibited by Mr. Harding.

The following exhibits were also made at the meetings:—

By WENTWORTH H. PRICE. Kite's egg, taken in Breconshire, on May 18th, 1891.

By C. T. VACHELL, M.D. Two skins of *Varanus gouldi*.

By T. W. PROGER. Casts by Mr. Clarke, of Llandaff, of gurnard, roach, and bream.

By J. J. NEALE. Large black coral, recently dredged from the Bay of Biscay.

The Committee regrets to have to report the death of Mr. James Bell and Mr. A. Pettigrew, who have been members of the Section almost since its foundation.

The accounts have been audited by Drs. P. Rhys Griffiths and H. R. Vachell, and show a balance in hand of £20 17s. 7d.

W. N. PARKER,
Hon. Sec.

UNIVERSITY COLLEGE, CARDIFF,
May 21st, 1903.

CARDIFF NATURALISTS' SOCIETY.

BIOLOGICAL AND GEOLOGICAL SECTION.

Account of Receipts and Payments for Session 1902-3.

	£	s.	d.		£	s.	d.
To Balance in hand	20 17 9	By cost of Meetings (Attendants, Jantern,	...	3 5 2	
„ 35 Subscriptions, at 2s. 6d.	4 7 6	Gas, Sending out Notices, Collect-	...	0 16 0	
				ing Subscriptions, &c.)	...	0 6 6	
				„ Postages...	...	20 17 7	
				„ Stationery	...		
				„ Balance in hand, May 21st, 1903	..		
						£25 5 3	

Audited and found correct,

HERBERT R. VACHELL.

P. RHYS GRIFFITHS.

W. N. PARKER, *Hon. Sec.*

UNIVERSITY COLLEGE, CARDIFF,

21st May, 1903.

ARCHÆOLOGICAL SECTION.

REPORT ON SESSION 1902-3.

OFFICERS AND COMMITTEE.

<i>President</i>	-	-	-	J. S. CORBETT.
<i>Hon. Sec. and Treas.</i>	-	-	-	J. W. RODGER.

Vice-Presidents :

C. H. JAMES.	R. DRAIN.
W. RILEY.	T. H. THOMAS.
Dr. C. T. VACHELL.	G. SEABOURNE.
E. SEWARD.	G. E. HALLIDAY.

Committee :

HOBSON MATTHEWS.	A. B. BASSETT.
JOHN WARD.	J. H. WESTYR-EVANS.
J. COATES-CARTER.	Dr. P. RHYS GRIFFITHS.

FINANCIAL STATEMENT.

The balance in hand is 8s. 11d.

MEMBERSHIP.

Twenty-six new members have joined during this Session, bringing the total membership to 48. Five papers were read during the winter of 1902-3, at which the average attendance was 13.

PAPERS.

Papers were read as follows :—

- Nov. 7th, 1902.* Mr. T. H. Thomas, R.C.A., on "Cup and Ring Rock Markings."
Dec. 9th, 1902. Mr. R. Drane, F.L.S., on "The Survival of a Primeval Habit in Mankind."
Jan. 27th, 1903. Mr. J. H. Westyr-Evans, on "Sully."

Feb. 20th, 1903. Mr. W. Riley, on "The Handiwork of Pre-Historic Man in the Neolithic Stone, Bronze, and Iron Ages."

April 3rd, 1903. Mr. J. S. Corbett, on "The Member Lordships of Glamorgan."

FIELD DAYS.

The following Excursions have been made :—

April 22nd, 1903. Train to Caerphilly, walk thence to "Cefn On," to see a supposed Roman road near Pant Glas Farm.

May 16th, 1903. Train to Caerphilly, walk thence to Castell-mor-Graig on Thornhill. On this occasion the party was entertained to tea by Mr. and Mrs. E. England, The Parc, near Llanishen.

July 1st, 1903. Train to Ystrad-Mynach, walking back over the Mountain to Caerphilly. The object of this excursion was to inspect a piece of supposed Roman road and a curious artificial ditch with mound.

The party was entertained to tea by the President and Mrs. Corbett.

September, 1903. Visit to Castell-mor-Graig.

The objects of these excursions have in each case been recorded by photographs placed in the Section's Album and are shown on the Section's Ordnance Maps.

EXPLORATION WORK.

Mr. John Ward's Report on The Roman Fort at Gellygaer has been published.

By kind permission of Lord Windsor (through Mr. R. Forrest), and at his expense, the Castell-mor-Graig on Thornhill has been partially explored, and has brought to light the ruins of a 13th Century Fort. The work was stopped for this year owing to the inclemency of the weather, but Lord Windsor has expressed his desire that the exploration shall proceed whenever the Society may deem it advisable to resume operations.

The total amount expended to date is £57 2s. 3d.

GENERAL.

A new rule has been added admitting Ladies to Membership of the Section.

Mr. J. S. Corbett, President, has, during this Session, presented to the Cardiff Naturalists' Society, for the use of the Archæological Section, a set of 14 Ordnance Maps, scale 6 inches to a mile, each map, mounted on holland and bound on the edges and enclosed in a purposely made iron strong box. This gift was supplemented by a purposely made folio in which to carry and protect any of the Maps during use on field work.

To aid in recording the work of the Section, the following books have been established:—

1. An Album in which photographs of objects of Archæological interest can be preserved.
2. A "Record Book," in which an account or description of all Archæological objects seen on Field days, shall be written.
3. A "Suggestion Book" for the purpose of recording any information on matters of Archæological interest known to the Members. These matters to be afterwards submitted for the consideration of the Committee, and, if thought suitable, to be recorded in the "Record Book."

JOHN W. RODGER,

November 19th, 1903.

Hon. Sec.

CARDIFF NATURALISTS' SOCIETY.

ARCHÆOLOGICAL SECTION.

Account of Expenditure and Receipts for the Year ending 31st August, 1903.

EXPENDITURE.		RECEIPTS.	
	£ s. d.		£ s. d.
To Cost of Meetings	By Balance from last year's Account	... ..
„ Stationery and Printing	„ Subscriptions	... ..
„ General Expenses and Postages
„ Balance to be carried to next year's Account
	£4 13 5		£4 13 5

WENTWORTH H. PRICE, F.C.A.,

Hon. Auditor.

CARDIFF, 16th October, 1903.

JOHN W. RODGER,

Hon. Secretary.

CARDIFF, 16th October, 1903.

GELLYGAER EXCAVATIONS.

COMMUNICATION TO THE COMMITTEE FROM THE ARCHÆOLOGICAL SECTION.

(Published by order of the Committee.)

TO THE PRESIDENT AND MEMBERS OF THE COMMITTEE OF
THE CARDIFF NATURALISTS' SOCIETY.

GENTLEMEN,

At a Meeting of the Archæological Section, held on the 3rd April, 1903, it was felt that, with the issue of the report on "The Gellygaer Excavations," the work of the Section was completed, and, by Resolution, we, the undersigned, were appointed to report to you thereon.

At the conclusion of such an important work, it would be well to review briefly the chief incidents in connection therewith.

In the autumn of 1899 your Society voted £25 to be expended in experimental research, with a view to ascertaining, if possible, whether the camp would justify the larger expense of thorough investigation. Mr. C. H. James took charge of this preliminary exploration, the result of which was that it was ascertained beyond doubt that here were the remains of a Roman Fort, the walls of which were hardly more than one spade in depth below the visible grassy surface. Your Society, through the Archæological Section, thereupon undertook the full exploration of the Fort, voting funds from its own resources, and soliciting outside help. This work was carried on systematically through the summers of 1900-1901, and Mr. Ward's report, recently published, marks the last step in

this very important undertaking which has now been concluded to the satisfaction of the Archæological Section of your Society.

The Archæological Section takes this opportunity of acknowledging its indebtedness, and expressing its gratitude to all those whose assistance has enabled it to bring this work to such a satisfactory conclusion.

Within the limits of a brief report it is impossible for us to mention all who have assisted towards this end, but the thanks of the Society are especially due to Mr. John Ward, who has, during the whole period of the excavation given the work his close care and attention. The efforts of Mr. Ward have only ceased with the issue of the report which has been most favourably received by the outside Archæological world. Thanks are also due to Mr. C. H. James for his efforts during the early period of the excavations, and for his generosity in defraying the cost of the illustrations in Mr. Ward's report; to Mr. Wm. Riley, who gave a great amount of his time to superintending, and for defraying the cost of a gang of workmen who were separately employed by him for several weeks; to Mr. G. Seabourne, who acted as pay-master to the workmen throughout; to Mr. J. W. Rodger, who made the surveys, to the Rev. T. J. Jones, Rector of Gellygaer, and to those members of the *rota* who faithfully fulfilled the obligations they had accepted.

JOHN STUART CORBETT, *President.*

T. H. THOMAS, *Vice-President.*

JOHN W. RODGER, *Hon. Sec.*

REPORT OF THE COMMITTEE

For the Year 1902-1903.

The Committee have pleasure in presenting to the members the Thirty-sixth Annual Report of the Society :—

The number of Members at the close of

last Session was	...	...	...	462
Elected during 1902-3	...	...	...	44
				<u>506</u>
Resignations and Removals	...		54	
Deaths	...	...	...	5
				<u>59</u>
				<u>447</u>

The Members are thus distributed :—

Honorary Members	...	...	...	8
Life Members	...	...	...	18
Corresponding Members	...	...	...	10
Annual Subscribers	...	...	...	411
				<u>447</u>

Your Committee much regret to record the loss by death during the past Session of five Members of the Society, viz. :—
Mr. Archibald Hood, Sir Edward Hill, K.C.B., Mr. James Bell, Mr. R. R. Watkins and Mr. S. Rees.

The following is a list of the Papers read before the Society, viz. :—

1902.

Oct. 7th. Annual Meeting. Presidential Address by D. R. Paterson, Esq., M.D., entitled "Some features of Bird Life in the Society's District."

1902.

- Oct. 30th. F. T. Howard, Esq., M.A., F.G.S. "Some Physical features of South Wales."
Nov. 13th. J. J. Neale, Esq. "Orchids."
Dec. 4th. Col. E. E. Markwick, F.R.A.S. "Some Astronomical Reminiscences."

1903.

- Jan. 22nd. Principal E. H. Griffiths, Sc.D., F.R.S. "Energy."
Feb. 25th. T. H. Thomas, Esq., R.C.A. "Local Folk-lore."

The following Public Lectures have been delivered during the year, viz.:—

1902.

- Oct. 16th. A. R. Colquhoun, Esq., M.I.C.E., F.R.G.S. "The Peoples of the Pacific."
Nov. 27th. Fred Enock, Esq., F.L.S. "Aquatic Autocrats and Fairies."
Dec. 11th. W. N. Shaw, Esq., F.R.S. "Weather Forecasting."
,, 18th. Sir H. H. Johnston, G.C.M.G., K.C.B. "Scenes and People from the Uganda Protectorate."

1903.

- Jan. 8th. Professor E. J. Garwood, M.A. "Volcanoes."
Feb. 5th. J. E. S. Moore, Esq., F.R.G.S. "To the Mountains of the Moon and back."
Mar. 12th. Richard Kerr, Esq., F.G.S. "Wireless Telegraphy."
,, 26th. Professor J. Graham Kerr, M.A. "A Naturalist in the Gran Chaco."

The thanks of the Society are due to the members who have read Papers, and also to the ladies and gentlemen who have entertained the Lecturers. During the Session the Cory Hall has been used for the Public Lectures, and the Y.M.C.A. Hall for the Members' Nights. Sir Harry Johnston's Lecture was illustrated not only by lantern slides, but by a Phonograph which reproduced the native songs of Uganda, and was listened to by a large and appreciative audience in the Park Hall.

The First Field Meeting was held on May 13th, 1903, when a visit was paid to the Electrical Power Station of the Cardiff Corporation Tramways. Mr. Arthur Ellis, the Borough Electrical Engineer, and his assistants, very kindly conducted the party.

The Annual Field Meeting (Ladies' Day) was held on July 15th, 1903, at Penllergaer, the seat of Sir John T. D. Llewelyn, Bart., D.L., J.P. The party numbered about 60, and after travelling to Swansea lunched at the Metropole Hotel, after which the Annual Meeting was held, when Mr. T. W. Proger was elected President for the coming Session. The members then drove in brakes to Penllergaer, where they were most kindly received by Sir John, Lady and Miss Llewelyn, and after inspecting the entomological collections and other objects of interest were conducted around the grounds and subsequently entertained to tea. After tea Sir John delivered a brief address to the members, and graphically outlined the aims and methods of study for a naturalist. The members drove to Swansea and returned by train after a most instructive and enjoyable day.

The Third Field Meeting was held at Caerwent on September 16th, 1903, when a visit was paid to the excavations of the Roman City at present in progress in the Amphitheatre Field and to the Museum. Over 60 members were present, and the party was met and conducted by Mr. A. Trice Martin, F.S.A., Secretary of the Caerwent Exploration Fund, Mr. A. E. Hudd, F.S.A., Treasurer of the Fund, Mr. Thomas Ashby, F.S.A., who has been superintending the excavations, and the Rev. W. A. Downing, M.A., Vicar of Caerwent.

The Gellygaer Report written by Mr. John Ward and published by Messrs. Bemrose and Sons has been issued to the members, and marks the completion of a most successful piece of Archæological research. Four hundred and fifty copies of the work were also printed for sale to the general public, and of these 248 have been sold, some going as far afield as Germany, and the Report has been enquired for and much appreciated by

Archæologists everywhere. Particulars of the receipts and expenditure were contained in the Memoir together with a full list of Subscriptions and Donations.

By the kind permission of Lord Windsor and at his expense (through Mr. R. Forrest) the Archæological Section has been engaged during the summer of 1903 in the exploration of Castell-Mor-Graig, on Thornhill, near Cardiff. Up to the present nothing appears to have been known as to the history of this fortress or its age. As a result of the exploration it is now known that the present structure dates from about the Thirteenth Century, and consists of a large central rectangular enclosure having a circular bastion at each angle, with a square "keep" on one side, placed midway between the bastions. Sufficient has been uncovered to enable a correct plan to be made, but more digging remains to be done if its full history as may be revealed by architectural details is to be fully known. The work of exploration has been carried out under the direction of Mr. John Ward, F.S.A.

The Conference of Corresponding Societies at the Annual Meeting of the British Association at Southport was attended by Principal E. H. Griffiths as the Society's delegate.

Since the last Report, volumes xxxiv. and xxxv. of the Transactions (1901-2, 1902-3) have been issued. Dr. D. R. Paterson has resigned the post of Editor of the Transactions after holding it for a period of ten years, and your Committee take this opportunity of acknowledging the very valuable services rendered by him in that capacity. Your Committee also has much pleasure in acknowledging the valuable work done by Mr. Henry Heywood in continuing to furnish the Meteorological Report for the Transactions.

The Annual Statement of Accounts is presented herewith.

CARDIFF NATURALISTS' SOCIETY.

 ESTABLISHED 1867.

Past Presidents.

- 1868—WILLIAM ADAMS, C.E., F.G.S.
 1869—WILLIAM ADAMS, C.E., F.G.S.
 1870—WILLIAM ADAMS, C.E., F.G.S.
 1871—WILLIAM ADAMS, C.E., F.G.S.
 1872—WILLIAM ADAMS, C.E., F.G.S.
 1873—WILLIAM ADAMS, C.E., F.G.S.
 1874—FRANKLEN G. EVANS, F.R.A.S., F.R.M.S.
 1875—JOHN WALTER LUKIS, M.R.I.A.
 1876—WILLIAM TAYLOR, M.D., &c.
 1877—JOHN WALTER LUKIS, M.R.I.A.
 1878—COLONEL PICTON TURBERVILL.
 1879—HENRY HEYWOOD, C.E., F.C.S.
 1880—LOUIS TYLOR.
 1881—CLEMENT WALDRON.
 1882—GEORGE E. ROBINSON.
 1883—WILLIAM GALLOWAY.
 1884—PETER PRICE.
 1885—C. T. VACHELL, M.D.
 1886—HENRY HEYWOOD, C.E., F.C.S.
 1887—J. V. JONES, M.A.
 1888—T. H. THOMAS, R.C.A.
 1889—W. RÖNNFELDT.
 1890—J. GAVEY.
 1891—C. T. VACHELL, M.D.
 1892—C. T. VACHELL, M.D.
 1893—C. T. WHITMELL, M.A.
 1894—EDWIN SEWARD, F.R.I.B.A.
 1895—R. W. ATKINSON, B.Sc., F.I.C.
 1896—REV. CANON THOMPSON, D.D.
 1897—ROBERT DRANE, F.L.S.
 1898—J. TATHAM THOMPSON, M.B.
 1899—C. T. VACHELL, M.D.
 1900—W. N. PARKER, Ph.D.
 1901—J. J. NEALE.
 1902—C. H. JAMES.
 1903—D. R. PATERSON, M.D.

OFFICERS AND COMMITTEE, 1903-4.

President.

T. W. PROGER.

Vice-Presidents.

J. J. NEALE ; C. H. JAMES, J.P. ; D. R. PATERSON, M.D.

Hon. Treasurer.

WENTWORTH H. PRICE, F.C.A.

Hon. Curator.

T. W. PROGER.

Hon. Librarian.

P. RHYS GRIFFITHS, M.B.

Hon. Secretary.

WILLIAM SHEEN, M.S., M.D., F.R.C.S.

Committee.

G. A. S. ATKINSON, B.Sc., F.R.A.S.

G. A. BIRKENHEAD.

WALTER COOK.

Rev. DAVID DAVIES, M.A.

Principal E. H. GRIFFITHS, Sc.D., F.R.S.

J. B. HAYCRAFT, M.D., D.Sc., F.R.S.E.

E. P. PERMAN, D.Sc., F.C.S.

W. W. PETTIGREW.

J. W. RODGER, M.S.A.

W. J. TROUNCE, J.P.

A. H. TROW, D.Sc.

J. E. WILLIAMS, M.A.

"Also such of the Past Presidents as shall in reply to an annual circular consent to serve on the Committee."

BIOLOGICAL AND GEOLOGICAL SECTION.**President.**

T. H. THOMAS, R.C.A.

Hon. Secretary.

W. N. PARKER, Ph.D., University College.

ARCHÆOLOGICAL SECTION.**President.**

J. S. CORBETT.

Hon. Secretary.

J. W. RODGER, M.S.A., 14, High Street.

CARDIFF NATURALISTS' SOCIETY.

Dr. Revenue Account for the Year ended 30th September, 1903. Cr.

	£	s.	d.		£	s.	d.
To Reports and Transactions	...	...	...	By Balance from last year's Account	...	...	...
" Members' Meetings	...	...	...	" Subscriptions (Ordinary)	...	...	...
" Stationery, Printing, and Advertising	...	...	...	" Dividends and Interest	...	...	...
" General Expenses	...	...	...	
" Field Meetings	...	...	...	
" Lectures	...	...	...	
" Conversazione Reserve Account	...	...	...	
" Endowment of Research Account	...	...	...	
" Depreciation of Furniture	...	£3	10 0				
" " Library	...	1	10 5				
			5 0 5				
" Balance to be carried to next year's Account	...	320	15 11				
			£667 5 5				

CARDIFF NATURALISTS' SOCIETY.

Dr.

Balance Sheet, 30th September, 1903.

Cr.

LIABILITIES.				ASSETS.			
£	s.	d.		£	s.	d.	
...	41	13	5	Value of Furniture	...	33	17 9
Sundry Creditors	...	...	...	" Library	...	3	0 0
Conversazione Reserve Account	...	...	...	Reports unsold	...	5	0 0
Endowment of Research Account	...	...	...	" "Flora" unsold	...	1	0 0
Gellygaer Excavation Account	...	...	...	Barry Railway Co., £200 4 per cent. Pre-			
Balance, being excess of Assets over Liabilities	...	320	15 11	ference Stock (at cost) including the			42 17 9
				amount of the Life Subscriptions	...		252 19 7
				Subscriptions in arrear	...		8 5 0
				Cash at Lloyds Bank, Ltd., viz. :—			
				Deposit Account	...	102	3 10
				Current Account	...	52	1 4
						154	5 2
						£458	7 6

T. W. PROGER, HON. AUDITOR.

WENTWORTH H. PRICE, F.C.A., HON. TREASURER.

CARDIFF, 10th October, 1903.

CARDIFF, 5th October, 1903.

CATALOGUE OF LIBRARY.

NOTE.—*The books and pamphlets belonging to the Society are deposited in the Reference Department of the Cardiff Free Library, where they may be consulted daily. Members are allowed to borrow the books for perusal upon presentation to the Librarian of their cards of membership.*

Alder (Joshua). Catalogue of the mollusca of Northumberland and Durham. 1848.	240
Catalogue of the zoophytes of Northumberland and Durham. 1857.	241
American Museum of Natural History, New York. Annual reports, etc. 1898 to date.	2115
Bulletin. Vol. IX., 1897, to date.	2115
Annaes de Sciencias Naturals. Vol. I., 1894, to date	2119
Argentine Republic. Museo Nacional. Anales. Vol. IV., 1895, to date.	324
Comunicaciones. Vol. I., 1898—in <i>progress</i>	324
Memorias. 1894-6.	324
Astronomical Society for Wales. Journal. Preliminary number, January, 1895; Vols. I.-III., 1895-1897.	116
The Cambrian Natural Observer. (Quarterly Journal of the A. S. W.) Vols. I.-IV., 1898-1901.	116
Bath Natural History and Antiquarian Field Club. Proceedings. Vol. I., 1867-9, to date.	256
Beale (L. S.). How to work with the microscope. 1880.	24
Belfast Natural History and Philosophical Society. Proceedings, 1872-3—1881-2	254
Reports and proceedings, 1882-3 to date	254
Belfast Naturalists' Field Club. Annual reports and proceedings. New series. Vol. I., 1873-1880, to date	263
Appendices. Vol. I., No. 3. Vol. II., No. 4, 1873-4	263
Guide to Belfast and the adjacent counties. 1874	11
Belfast, 1902. A guide to Belfast and the counties of Down and Antrim, prepared for the British Association. 1902	119
Berwickshire Naturalists' Club. History. 1875 to date	261
Brighton and Sussex Natural History and Philosophical Society. Annual report and abstract of proceedings, 1875-8, 1880-1892	262
Bristol and Gloucestershire Archæological Society. <i>Monmouth meeting</i> . Papers on Monmouth Castle and Priory; the Raglan Castle; Grosmont; Skenfrith; Whitecastle; Pembridge. 1896	41
Bristol Naturalists' Society. Laws, 1875	255
Lists of officers, etc.; Annual reports, etc.	255
Proceedings. New series. Vol. III., 1868 to date	255

British Association. Reports of meetings, 1842-5, and 1896 to date	23
York Meeting. Conference of Delegates of Scientific Societies.	
Circular referring to subjects recommended for investigation	
by local scientific societies. 1882	234
British Museum. (Natural History). General guide with plans and	
views of the building. 1901	2151
Handbook of instructions for collectors. 1902.	118
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Guldberg (C. M.) and Nohn (H.) <i>Études sur les mouvements de l'atmosphère.</i> 2 pts. 1876-1880.	
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Universitets Program. Pt. II. 1897.	
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Etheridge (R.), <i>junr.</i> Contributions to a catalogue of works, reports, etc., of the Australian and Tasmanian aborigines. Part I. 1890.	

New South Wales.

Geological Survey. Memoirs, cont'd.

Etheridge (R.) *junr. cont'd.* A monograph of the carboniferous and permio-carboniferous invertebrata of New South Wales. 2 parts. 1891-2.

Part I. Oolenterata.

" II. Echinodermata, annelida, and crustacea.

Etheridge (R.), *junr.*, and Olliff (S.) The mesozoic and tertiary insects of New South Wales. 1890.

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4. Watt (J. A.) Notes on the occurrence of Bismuth ore.

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6. Carne (J. E.) The copper-mining industry and the distribution of copper ores.

7. Mercury or quicksilver, with notes on its occurrence in other colonies and countries.

8. Andrews (E. C.) Report of the Hillgrove gold-field.

9. Report of the Yalwal gold-field.

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- 39M. Lo Bianco (S.) The methods employed at the Naples zoological station for the preservation of marine animals. 1899.
- 39N. Miller (U. S.) Directions for preparing study specimens of small mammals. 1901.
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40. Foster (L. S.) The published writings of George Newbold Lawrence, 1844-1891. (*Bibliographies of American naturalists, IV.*) 1892.
41. Goode (G. Brown). The published writings of Dr. Charles Girard. (*Bibliographies of American naturalists, V*) 1891.
42. Dewey (F. P.) A preliminary descriptive catalogue of the systematic collections in economic geology and metallurgy in the United States National Museum. 1891.
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45. Ashmead (W. H.) Monograph of the North American proctotrypidae. 1893.
46. Bollman (O. H.) and Underwood (L. M.) The myriapoda of North America. 1893.
47. Jordan (D. S.) and Evermann (B. W.) The fishes of North and Middle America. A descriptive catalogue. 3 vols. 1896-8.
48. Smith (J. B.) Contribution toward a monograph of the insects of the lepidopterous family noctuidæ of boreal North America. A revision of the deltoid moths. 1895.
49. Goode (G. Brown). Bibliography of the published writings of P. L. Sclater, secretary of the Zoological Society of London. 1896.
50. Ridgway (R.) The birds of North and Middle America : a descriptive catalogue. Vols. I-II., 1901-2.

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- II. Goode (G. B.) and Bean (I. H.) Oceanic ichthyology: deep-sea and pelagic fishes of the world. 1895.
- III. Bendire (Charles). Life histories of North American birds: their breeding habits and eggs. 1895.

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100. Warman (P. C.) Bibliography and index of the publications of the United States Geological Survey. 1893.	
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102. Boyle (C. Breckinridge). Catalogue and bibliography of North American mesozoic invertebrata. 1893.	
103. Barnes (C.) High temperature work in igneous fusion and ebullition. 1893.	
104. Weed (W. H.) The glaciation of the Yellowstone Valley, north of the Park. 1893.	
105. West (W. H. and Knowlton (F. H.) The Laramie and the overlying Livingston formation in Montana. Report on flora. 1893.	
106. Stanton (T. W.) The Colorado formation and its invertebrate fauna. 1893.	
107. Kemp (J. F.) and Marsters (V. F.) The Trap Dikes of the Lake Champlain Region. 1893.	
108. Russell (I. C.) A geological reconnaissance in Central Washington. 1893.	
109. Bayley (W. S.) The eruptive and sedimentary rocks on Pigeon Point, Minnesota, and their contact phenomena. 1893.	
110. Peale (A. C.) and Merrill (G. P.) The paleozoic section in the vicinity of Three Forks, Montana. Petrographic notes. 1893.	

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111. Campbell (M. R.) *Geology of the Big Stone Gap coalfield of Virginia and Kentucky.* 1893.
112. Perrine (C. D.) *Earthquakes in California in 1892-1893.*
113. Division of chemistry. *Report, 1891-1893.*
114. Perrine (C. D.) *Earthquakes in California in 1893-1894.*
115. Gannett (H.) *A geographic dictionary of Rhode Island.* 1894.
116. *A geographic dictionary of Massachusetts.* 1894.
117. *A geographic dictionary of Connecticut.* 1894.
118. *A geographic dictionary of New Jersey.* 1894.
119. Ekiridge (G. H.) *A geographical reconnaissance of North-west Wyoming.* 1894.
120. Prosser (C. S.) *The Devonian system of Eastern Pennsylvania and New York.* 1894.
121. Keyes (O. R.) *A bibliography of North American paleontology, 1888-1892.* 1894.
122. Gannett (H.) *Results of primary triangulation.* 1894.
123. *A Dictionary of geographic positions.* 1895.
124. Scudder (S. H.) *Revision of the American fossil cockroaches.* 1895.
125. Clarke (F. W.) *The constitution of the silicates.* 1895.
126. Emerson (B. K.) *A mineralogical lexicon of Franklin, Hampshire, and Hampden Counties, Massachusetts.* 1895.
127. Darton (N. H.) *Catalogue and index of contributions to North American geology, 1732-1891.* 1896.
128. White (C. A.) *The Bear river formation and its characteristic fauna.* 1895.
129. Perrine (C. D.) *Earthquakes in California in 1894-1895.*
130. Weeks (F. B.) *Bibliography and index of North American geology, paleontology, petrology, and mineralogy, for 1892 and 1893.* 1896.
131. Newell (F. H.) *Report of progress of the division of hydrography for 1893-4.* 1895.
132. Winslow (A.) *The disseminated lead ores of South-eastern Missouri.* 1896.
133. Stanton (T. W.) *The fauna of the Knoxville Beds. (Contributions to the cretaceous paleontology of the Pacific Coast.)* 1895.
134. Walcott (O. D.) *The Cambrian rocks of Pennsylvania.* 1896.
135. Weeks (F. B.) *Bibliography and index of North American geology, paleontology, petrology, and mineralogy for 1894.* 1896.
136. Bascom (F.) *The ancient volcanic rocks of South Mountain, Pennsylvania.* 1896.
137. Hay (R.) *The geology of the Fort Riley military reservation and vicinity, Kansas.* 1896.
138. Darton (N. H.) *Artesian well prospects in the Atlantic coastal plain region.* 1896.
139. Weed (W. H.) and Pirsson (L. V.) *Geology of the Castle Mountain mining district, Montana.* 1896.
140. Newell (F. H.) *Report of progress of the division of hydrography for 1895.* 1896.
141. Clark (W. B.) *The eocene deposits of the middle Atlantic slope in Delaware, Maryland, and Virginia.* 1896.
142. Vaughan (T. W.) *A brief contribution to the geology and paleontology of North-Western Louisiana.* 1896.
143. Branner (J. O.) *Bibliography of clays and the ceramic arts.* 1896.
144. Told (J. E.) *The moraines of the Missouri Outcrop and their attendant deposits.* 1896.
145. Fontaine (W. M.) *The Potomac formation in Virginia.* 1896.
146. Weeks (F. B.) *Bibliography and index of North American geology, paleontology, petrology, and mineralogy for 1895.* 1896.
147. Perrine (C. D.) *Earthquakes in California in 1895.* 1896.
148. Clarke (F. W.) and Hillebrand (W. F.) *Analyses of rocks, with a chapter on analytical methods.* 1897.

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149. Weeks (F. B.) Bibliography and index of North American geology, paleontology, petrology, and mineralogy for 1896. 1897.
150. Diller (J. S.) The educational series of rock specimens collected and distributed by the Survey. 1898.
151. Hill (R. T.) and Vaughan (T. W.) The lower cretaceous gryphaeas of the Texas region. 1898.
152. Knowlton (F. H.) Catalogue of the cretaceous and tertiary plants of North America. 1898.
153. Weller (S.) A bibliographic index of North American carboniferous invertebrates. 1898.
154. Gannett (H.) A gazetteer of Kansas. 1898.
155. Perrine (C. D.) Earthquakes in California in 1896 and 1897. 1898.
156. Weeks (F. B.) Bibliography and index of North American geology, paleontology, petrology, and mineralogy for 1897. 1898.
157. Hall (C. W.) The gneisses, gabbro-schists, and associated rocks of South-Western Minnesota. 1899.
158. Todd (J. E.) The moraines of South-Eastern South Dakota and their attendant deposits. 1899.
159. Emerson (B. K.) The geology of Eastern Berkshire County, Massachusetts. 1899.
160. Gannett (H.) A dictionary of altitudes in the United States. 1899.
161. Perrine (C. D.) Earthquakes in California in 1898. 1899.
162. Weeks (F. B.) Bibliography and index of North American geology, paleontology, petrology, and mineralogy for 1898. 1899.
163. Knowlton (F. H.) Flora of the Montana formation. 1900.
164. Vaughan (T. W.) Reconnaissance in the Rio Grande coalfields of Texas. 1900.
165. Williams (H. S.) and Gregory (H. E.) Contributions to the geology of Maine. 1900.
166. Gannett (H.) A gazetteer of Utah. 1900.
167. Clarke (F. W.) Contributions to chemistry and mineralogy from the laboratory of the Survey. 1900.
168. Clarke (F. W.) Analyses of rocks from the laboratory of the Survey, 1880-1899. 1900.
169. Gannett (H.) Altitudes in Alaska. 1900.
170. Goode (R. U.) Survey of the boundary line between Idaho and Montana. 1900.
171. Gannett (H.) Boundaries of the United States and of the several States and Territories. 1900.
172. Weeks (F. B.) Bibliography and index of North American geology, paleontology, petrology, and mineralogy, 1899. 1900.
173. Nickles (J. M.) and Bassler (R. S.) A synopsis of American fossil bryozoa (including bibliography and synonymy). 1900.
174. Baker (M.) Survey of the North-Western boundary of the United States, 1857-1861. 1900.
175. Fitch (C. H.) Triangulation and spirit levelling in Indian Territory. 1900.
176. Hillebrand (W. F.) Some principles and methods of rock analyses. 1900.
177. Warman (P. C.) Catalogue and index of the publications of the United States Geological Survey, 1880-1901. 1901.
178. Reed (W. H.) The El Paso tin deposits. 1901.
179. Hay (O. P.) Bibliography and catalogue of the fossil vertebrata of North America. 1902.
180. Pratt (J. H.) The occurrence and distribution of corundum in the United States. 1901.
181. Wilson (H. M.) and others. Results of primary triangulation and primary traverse, 1900-01. 1901.
182. Ransome (F. L.) Report on the economic geology of the Silverton Quadrangle, Colorado. 1901.
183. Gannett (H.) A gazetteer of Porto Rico. 1901.

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184. Adams (G. I.) Oil and gas fields of the Western Interior and Northern Texas and the Western Gulf Coast. 1901.
185. Wilson (H. M.) and others. Results of spirit levelling, 1900-01. 1901.
186. Stokes (H. N.) On pyrite and marcasite. 1901.
187. Baker (M.) Geographic dictionary of Alaska. 1902.
188. Weeks (F. B.) Bibliography of North American geology, paleontology, petrology, and mineralogy, for 1892-1900. 1902.
189. Weeks (F. B.) Index to North American geology, paleontology, petrology, and mineralogy, for 1892-1900. 1902.
190. Gannett (H.) A gazetteer of Texas. 1902.
191. Weeks (F. B.) North American geologic formation names, bibliography, synonymy, and distribution. 1902.
192. Gannett (H.) A gazetteer of Cuba. 1902.
193. Kemp (J. F.) The geological relations and distributions of platinum and associated metals. 1902.
194. Baker (M.) The North-west boundary of Texas. 1902.
195. Dale (T. N.) Structural details in the Green Mountain region and Eastern New York (second paper). 1902.
196. Diller (J. S.) Topographic development of the Klamath Mountains. 1902.
197. Gannett (H.) The origin of certain place names in the United States. 1902.
198. Griswold (W. T.). The Berea grit oil sand in the Cadiz Quadrangle, Ohio. 1902.
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200. Campbell (M. R.) Reconnaissance of the borax deposits of Death Valley and Mohave Desert. 1902.
201. Wilson (H. M.) and others. Results of primary triangulation and primary traverse, 1901-2. 1902.
202. Lindgren (W.) Tests for gold and silver in shales from Western Kansas. 1902.
203. Weeks (F. B.) Bibliography and index of North American geology, paleontology, petrology, and mineralogy for 1901. 1902.
204. Knowlton (F. H.) Fossil flora of the John Day Basin, Oregon. 1902.
205. Shattuck (G. B.) and Vaughan (T. W.) The mollusca of the Buda limestone, with appendix on corals. 1903.
206. Cleland (H. F.) A study of the fauna of the Hamilton formation of the Cayuga Lake section in Central New York. 1903.
207. Clarke (F. W.) and Steiger (G.) The action of ammonium chloride upon silicates. 1902.

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- Vol. XVII. Lesquerenx (Leo). The flora of the Dakota Group. 1891.
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F. Geological Transactions.

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Fisher, R.	... 16, Windsor Place.
Fisher, R. S.	... 8, Dumfries Place.
Foster, W.	... 20, Glynrhondda Street.
Fox, G. H.	... 183, Cathedral Road.
Franklen, T. Mansel	... Westgate Street.
Galloway, Prof. W.	... Royal Buildings, Park Place.
Geen, William	... Linden, Penylan.
George, J. E.	... 2, St. Andrew's Place.
Gilling, H. T. (LL.B.)	... 54, Cathedral Road.
Gorvin, Mrs. M.	... 6, Windsor Esplanade,
Gottwaltz, L.	... 11, Beach Road, Penarth.
Graham, William	... Rockcliffe, Barry.
Green, Henry	... 50, Plymouth Road, Penarth.
Greig, W.	... The Beeches, Llandaff.
Griffiths, Principal E. H. (Sc.D., F.R.S.)	University College.
Griffiths, Dr. P. Rhys	... 50, Newport Road.
Griffiths, W.	... Old Well, Penylan.
Grimes, J.	... 92, Claude Road.
Gunn, Sir John (J.P.)	... Ty-to-Maen, St. Mellons.
Hacquoil, F. P.	... 16, Victoria Square, Penarth.
Hall, Capt. Edward	... 17, Richmond Road.
Hallett, George	... Cranford House, Victoria Square, Penarth.

Hallett, H. M.	... 18, Victoria Square, Penarth.
Hallett, J. H. (J.P.)	... Radyr Chain, Llandaff.
Halliday, G. E.	... Fairwater Road, Llandaff.
Hancock, Mrs. E.	... 51, The Parade.
Handcock, E.	... Castlefield, Rumney Hill.
Handcock, H. H.	... Treleaven, Penarth.
Harper, A.	... 21, Plymouth Road, Penarth.
Harper, Reuben	... 31, Ninian Road.
Harpur, W. (M.I.C.E.)	... Town Hall.
Harrison, F. G.	... Borough Treasurer's Office.
Harrison, J. B.	... North View, Romilly Road.
Haycraft, Prof. J. B. (M.D., D.Sc.)	... University College.
Hedley, The Rt. Rev. Bishop	... Bishop's House, Llanishen.
Henderson, Rev. A.	... The Vicarage, Charles Street.
Heywood, C. A.	... Holme Tower, Penarth.
Heywood, Henry (J.P., F.R. Met. Soc.)	... Witla Court, St. Mellons.
Higman, F. S.	... Y.M.C.A., Station Terrace.
Hodges, G. H.	... Old Post Office Chambers, Bute Docks.
Hooper, Miss	... 92, Richards Terrace.
Hooper, W. R.	... 75, Richmond Road.
Howard, C. F.	... 59, Despenser Street.
Howell, James (J.P.)	... Richmond Road.
Howell, James (Junr.)	... 1, Richmond Crescent.
Hughes Coun. R. (J.P.)	... 21, Park Place.
Hughes, T. (F.I.C., F.C.S.)	... 31, Loudoun Square.
Hunt, Dr. De Vere	... 41, Cathedral Road.
Hurley, E. C.	... 5, Church Road, Penarth.
Hutchins, E. E.	... 26, Plasturton Gardens.
Huxtable, W. D.	... 8, Richmond Terrace.
Ingledeu, Mrs. J. P.	... 9, Cathedral Road.
Insole, G. F.	... Fairwater House, near Cardiff.
Isaac, Noel	... Elm Grove, Dinas Powis.
Ives, Rev. R. J.	... St. German's Clergy House, Metal Street.
Jackson, Franklin	... 16, Windsor Terrace, Penarth.
James, A. P.	... 9, Windsor Place.
James, C. H. (J.P.)	... 64, Park Place.
James, C. Russell	... 5, Raymond Buildings, Gray's Inn, London, W.C.
James, Rev. D. T. R.	... Church House, Canton.
James, W. H.	... 1, Partridge Road.
James, W. P.	... The Lindens, Romilly Crescent.
Jefferis, Walter H. (LL.B.)	... Westbourne Road, Penarth.
Jenkins, D.	... 35, Victoria Road, Penarth.
Jenkins, Rev. D. (B.A.)	... 61, Clive Street, Grangetown.
Jenkins, Edward	... The Laurels, Radyr.

Jenkins, Miss J.	... 56, Richmond Road.
Jenkins, John	... 10, Westgate Street.
Jenks, E.	... 28, Park Place.
Jones, Arthur	... 14, Morlais Street.
Jones, D. Sibbering	... Penrhiw, Park Road, Barry.
Jones, Griffith (M.A.)	... Tresco, Penarth.
Jones, H. G.	... 71, Richmond Road.
Jones, J. A.	... 40, Newport Road.
Jones, J. Griffith	... Brynhyfryd, Pontypridd.
Jones, O. H. (J.P.)	... Fonmon Castle, near Cardiff.
Jones, Rees (J.P.)	... Finchley House, Newport Road.
Jones, Trevor	... 31, Park Place.
Jones, Watkin	... 51, Park Place.
Jones, W. Lester	... Llandough House, Llandough.
Jones, W. Southwell	... Insurance Buildings, New Street.
Jordan, Dr. E. Irvine	... Penarth.
Jotham, T. W.	... St. Mary Street.
King, Dr. J. C.	... Mount Sorrel, Barry.
Kirkhouse, H.	... Hazelwood, Cathedral Road.
Knapp, W. C. W.	... 7, Piercefield Place.
Laurel, Robert G.	... 20, Cwrt-y-vil Road, Penarth.
Lee, Major-General H. H. (J.P.)	... The Mount, Dinas Powis.
Leeds, Miss	... 5, Wellfield Road.
Leigh, Mrs.	... Glyn Bargoed, Treharris, R.S.O.
Leigh, Miss Nellie	... Abernant House, Nelson.
Lewis, E. W.	... Oak Villa, Caerphilly.
Lewis, Gething (J.P.)	... 125, Cathedral Road.
Lewis, T. E.	... 20, Plymouth Road, Penarth.
Lewis, William	... 22, Duke Street.
Lewis, W. H. (J.P.)	... Bryn Rhos, Llanishen.
Lewis, W. M.	... Llanishen.
Lewis, W. T. Watkin (J.P.)	... Maplewood, Llandaff.
Leyshon, R. H.	... 51, Hamilton Street.
Littledale, Prof. H.	... Baroda, Llandaff.
Lindsay, Capt. Lionel	... County Police Station, Cardiff.
Lindsay, Lt.-Col. H. E. M. (J.P.)	... Ystrad Mynach.
Linton, H. P.	... 3, Llandaff Place.
Llewelyn, Sir J. T. D. (Bart., J.P.)	... Penllergaer, Swansea.
Lovell, Thomas	... 17, Ruthin Gardens.
Low, A.	... 11, Glossop Terrace.
Loveridge, T.	... Kiltarnan, Plymouth Road, Penarth.
Lowdon, Ald. J. (J.P.)	... St. Hilda's, Barry.
Lucovich, Count A. T. de	... Llandaff Rise.
Lucy, C. Wentworth	... Andrew's Buildings, Queen Street.
Lundie, G. A.	... 136, Newport Road.

Mackay, G. D.	... 28, Cathedral Road.
Maclean, Dr. Ewen J.	... 12, Park Place.
Mann, H.	... 6, Kyveillog Street.
Masters, Mrs.	... Lanelay Hall, Llantrisant.
Martin, W. Tyson	... Bella Vista, Park Road, Penarth.
Mee, Arthur (F.R.A.S.)	... Tremynfa, Llanishen.
Merrils, J. M.	... 109, St. Mary Street.
Mewton, W. H.	... 11, Marine Parade, Penarth.
Miles, J.	... Frethaven, Llanishen.
Milner, J.	... 7, St. Andrew's Crescent.
Mont-Wilson, Miss L. A.	... The Infirmary. [arth.
Moore, John	... Greylands, Marine Parade, Pen-
Morel, Philip, (J.P.)	... Cliff Road, Penarth.
Morgan, Arthur	... The Mount, Llandaff Road.
Morgan, Arthur T.	... Hazeldene, Radyr.
Morgan, Bonner	... 46, Penylan Road.
Morgan, James	... 9, St. Andrew's Crescent.
Morgan, John	... 39, The Parade.
Morgan, J. Ll.	... Bryn Teilo, Llandaff Place.
Morgan, Coun. Lewis	... 100, Cathedral Road.
Morgan, W. A.	... Glen Lyn, Cathedral Road.
Morley, H.	... Gas Works, Bute Terrace.
Morris, Dr. W. D. J.	... 18, Crwys Road.
Mullin, Dr. J. (J.P.)	... 56, Conway Road.
Mullins, J. H. M.	... Preswylfa, Canton.
Munn, Coun. James	... 6, Piercefield Place.
Nance, W. E.	... 23, Westbourne Road, Penarth.
Neale, J. J.	... Lynwood, Park Road, Penarth.
Newman, B.	... 13, Howard Gardens.
Nicholson, C. S. (F.L.S.)	... 31, Copthall Avenue, London, E.C.
Norton, John	... 22, Richmond Road.
Owen, Evan (J.P.)	... 30, Ruthin Gardens.
Page, E. H.	... Llanishen.
Parker, T. C.	... 329A, Cowbridge Road.
Parker, Prof. W. N. (Ph.D.)	... Crowland, Cardiff Road, Llandaff.
Paterson, Dr. D. R.	... 15, St. Andrew's Crescent.
Pedersen, S.	... 163, Cathays Terrace.
Perkins, C. C.	... 3, Clare Gardens.
Perman, E. P. (D.Sc., F.C.S.)	... University College.
Perry, F. L.	... Victoria Road, Penarth.
Pettigrew, W. W.	... Roath Park.
Phillips, J. H.	... Clive Chambers, Windsor Place.
Pope, Mrs.	... 47, Claude Road.
Powell, S.	... 66, Park Place.
Price, Richard	... The Hayes, Llantwit Major.
Price, S. J.	... 146, Newport Road.

Price, Dr. William	... 40, Park Place.
Price, Wentworth H.	... 25, Newport Road.
Prichard, Dr. R.	... 14, Windsor Place.
Proger, T. W.	... 69, Richmond Road.
Pugh-Jones, D.	... Tymawr Road, Llandaff.
Radcliffe, C.	... 23, Dumfries Place.
Read, H.	... 20, Pencisely Road, Penhill.
Reece, E. B.	... Eason Villa, Newport Road.
Reece, E. T. B.	... Eason Villa, Newport Road.
Rees, Dr. Alfred	... 29, Cathedral Road.
Rees, Mrs. Treharne	... Blanyfant, Newport, Mon.
Renwick, Coun. W. H. (J.P.)	... 78, Cathedral Road.
Reynolds, Llwyarch	... Old Church Place, Merthyr Tydfil.
Reynolds, R. E.	... Dinas Powis.
Richards, William	... Gabalfa, near Cardiff.
Riches, Carlton H.	... Park Grove.
Riley, W. (J.P.)	... Newcastle House, Bridgend.
Roberts, Edward	... 19, Howard Gardens.
Roberts, Ivor J.	... 25, Cathedral Road.
Roberts, W. E.	... 109, Claude Road.
Robertson, G.	... 177, Newport Road.
Robinson, P. A. Vyvyan (J.P.)	... Bute Docks.
Rodger, J. W. (M.S.A.)	... 14, High Street.
Roe, Rev. Bernard	... St. Peter's.
Rogers, Fred J.	... 6, Glossop Terrace.
Rogers, J. S.	... 6, Glossop Terrace.
Rönnfeldt, W.	... 43, Park Place
Rosser, W. D.	... 178, Newport Road.
Rowe, Edwin	... 195, Newport Road.
Rule, Miss A.	... Radnor Road Board School.
Sadler, H.	... Bradford Place, Penarth.
Salmon, H. E.	... 22, Richmond Road.
Sanday, W. A.	... 29, Marlborough Road.
Sanderson, R. O.	... 193, Cathedral Road.
Sankey, John	... 239, Newport Road.
Sargeaunt, A. W.	... 50, The Parade.
Schaepe, R. F.	... 22, Morlais Street.
Scott, Robert	... 17, Dumfries Place.
Scott, W. Gilbert	... 52, Richmond Road.
Scull, H. P.	... 7, Oakfield Street.
Seaborne, George	... Brynheulog, Hengoed.
Seccombe, G. A.	... 35, Newport Road.
Seel, R. H.	... Glen Luce, Dinas Powis.
Selby, Prof. A. L. (M.A.)	... University College.
Seward, Edwin	... Lisvane, near Cardiff.
Shackell, E. W. (J.P.)	... 191, Newport Road.
Sharman, J. P.	... 82, Colum Road.

Shaw, F.	... 8, Windsor Terrace, Penarth.
Sheard, G. H.	... 10, Gordon Road,
Shepherd, David	... 26, Windsor Place.
Shepherd, Gilbert D.	... 26, Windsor Place.
Shepton, G. C.	... 3, Park Grove.
Shout, W. C.	... Dinas Powis.
Sibbering, G. T.	... Park Road, Barry.
Sievevright, J. D.	... 240, Newport Road.
Simpson, Mrs.	... 45, Richmond Road.
Simpson, Mrs.	... 24, Wordsworth Avenue.
Sloggett, G.	... 35, Stacey Road.
Smart, E. G.	... 10, Clive Place, Penarth.
Smith, Mrs. Rowland	... 5, East Grove.
Snell, C.	... 6, Stanwell Road, Penarth.
Southern, R. W. A.	... 33, The Parade.
Spence, J.	... Hartford Lodge, Victoria Road, Penarth.
Spencer, C. St. D.	... 6, Working Street.
Staniforth, A. W.	... 6, Church Street.
Stephens, Alfred L.	... 24, Cwrt-y-vil Road, Penarth.
Stephens, T. H. (J.P.)	... Maidstone, Cathedral Road.
Stephens, W. E.	... L. and P. Bank, Roath.
Stevens, T.	... 136, Queen Street.
Stowe, Richard (B.A.)	... 24, Richmond Road.
Stracey, H. J.	... 7, Windsor Terrace, Penarth.
Strawson, J. Y.	... 21, Victoria Road, Penarth.
Stuckey, G. F.	... 17, Park Place.
Sully, G. E.	... Heimat, Archer Road, Penarth.
Symonds, W.	... 17, Romilly Road.
Tanner, Prof. H. W. Lloyd	... University College.
Taylor, J. W.	... 7, Lake Road East.
Taylor, William	... 2, Dock Chambers.
Thatcher, H. J.	... 3, Glossop Terrace.
Thomas, C. Carey	... 52, Plymouth Road, Penarth.
Thomas, Dr. J. Lynn (C.B., J.P.)	... Green Lawn, Penylan.
Thomas, J. W.	... 25, Richmond Road.
Thomas, Miss N.	... 14, Southey Street.
Thomas, Robert	... 9, Clive Crescent, Penarth.
Thomas, T. H. (R.C.A.)	... 45, The Walk.
Thomas, Thomas	... 7, Adamsdown Square.
Thompson, Charles	... Penhill Close, Llandaff.
Thompson, Prof. C. M. (M.A.)	... University College.
Thompson, G. Carslake	... Park Road, Penarth.
Thompson, H. M.	... Whitley Batch, Llandaff.
Thompson, H. Woolcott	... 38, Park Place.
Thompson, Dr. J. Tatham	... 24, Windsor Place.
Tilley, James	... 21, Archer Road, Penarth
Townend, T. M.	... Crofton, Radyr.

Travis, A. W.	... 18, Plymouth Road, Penarth.
Tredeggar, Right Hon. Lord	... Tredeggar Park, Newport, Mon.
Tregelles, T. S.	... Huntworth, Archer Road, Penarth
Trerise, James	... 60, Oakfield Street.
Trounce, Ald. W. J. (J.P.)	... 67, Newport Road.
Trow, A. H. (D.Sc.)	... Glanhafren, Penarth.
Vachell, A. C.	... Park House, Park Place.
Vachell, C. T. (M.D., J.P.)	... 11, Park Place.
Vachell, H. R. (M.D.)	... 18, Newport Road.
Vaughan, E. M. Bruce	... 14, Newport Road.
Waddell, William	... Romilly Road, Barry.
Wakeford, C. Edgar	... Tytherly, Dinas Powis.
Wakley, Miss F. E.	... 132, Claude Road.
Waldron, Clement	... The White House, Llandaff.
Waldron, C. R.	... Penpentre, Llandaff.
Walford, Dr. E.	... Town Hall.
Walker, T. A.	... 19, Cwrt-y-vil Road, Penarth.
Ward, John (F.S.A.)	... The Welsh Museum, Cardiff.
Ware, W. (J.P.)	... Cwmwbwb, Caerphilly.
Watkins, Miss	... 41, Westbourne Road, Penarth.
Watson, T. E.	... Exchange, Cardiff.
Waugh, James (M.A.)	... 290, Newport Road.
Webb, H.	... 34, Cathedral Road.
Webb, Mrs. H.	... 34, Cathedral Road.
Westyr-Evans, J. H.	... Cefn Bryn, Penarth.
Wheatley, J. L.	... 174, Newport Road.
Whiteside, Rev. M.	... St. Nicholas Rectory, St. Nicholas
Whitwham, L. P.	... 25, Windsor Terrace, Penarth.
Williams, Arthur	... 32, Connaught Road.
Williams, D. R.	... 14, Princes Street.
Williams, D. T.	... 9, The Parade.
Williams, E. Jenkin	... 52, Park Place.
Williams, Jesse	... 29, Windsor Place.
Williams, G. C. (J.P.)	... Llanrumney Hall, St. Mellons.
Williams, T. J.	... 34, Newport Road.
Williams, Dr. W.	... 42, Plymouth Road, Penarth.
Williams, W. E. O.	... Cardiff Road, Llandaff.
Woods, G. A.	... 162, Cathedral Road.
Woods, Lt.-Col T. (J.P.)	... 2, Llandaff Place, Llandaff.
Yorath, Coun. W. L.	... 135, Richmond Road.

CARDIFF :
WILLIAM LEWIS, PRINTER, DUKE STREET.

TRANSACTIONS OF THE
CARDIFF NATURALISTS' SOCIETY

VoL. XXXVII.

1904.

Cardiff Naturalists' Society

REPORT AND TRANSACTIONS

Vol. XXXVII.

1904

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1905

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METEOROLOGICAL OBSERVATIONS IN THE SOCIETY'S DISTRICT, 1903.

BY H. HEYWOOD, F.R. MET. SOC.

IN presenting to the readers of this section of the Society's Transactions the Rainfall records for the year 1903, the Averages (in most instances for the previous fifteen years) have been continued.

The average monthly rainfall over the whole of the Society's district (comprised within a semi-circular area, having the Beacons as its most northernmost point, its base the coast line from Neath to Chepstow, and with a mean height of 552 feet above the sea level) is as follows :—

January	...	...	...	7·67 inches.
February	...	...	...	4·19 „
March	...	...	...	8·29 „
April ...	...	...	...	2·61 „
May ...	...	...	...	4·46 „
June ...	...	...	...	2·35 „
July ...	...	...	...	3·84 „
August	...	...	...	7·72 „
September	...	...	...	5·34 „
October	...	...	...	13·18 „
November	...	...	...	3·26 „
December	...	...	...	4·99 „
Total				<hr/> 67·90 <hr/>

OBSERVERS.					FEET ABOVE SEA LEVEL.	INCHES OF RAIN.
C. H. PRIESTLEY, Summit of Tyle Brith, Brecknockshire...					2350	95'18
„ Nant Penig					2000	108'46
„ Storey Arms					1430	95'49
„ Taff Fawr					1340	113'16
WM. JONES, Pontlluest Wen Reservoir, Glam.					1255	80'53
C. H. PRIESTLEY, Pentwyn Uchaf					1143	81'20
HENRY C. STEEL, Blaenavon, Mon.					1135	76'81
C. H. PRIESTLEY, Cantreff Reservoir, Brecknockshire					1120	93'74
*R. C. HARRISON, Gwernllwyn, Dowlais					1084	73'97
G. A. BROWN, Tredegar... ..					1024	83'08
FORSTER BROWN & REES, Glyncorrwg					717	110'82
W. T. LEWIS (Sir, Bart.), Bute Merthyr Colliery, Treherbert					670	108'30
GOMER S. MORGAN, Pontyclun, Glam.					582	81'97
B. S. LYSAGHT (Mrs.), Dannel Hill, Chepstow					580	43'21
W. T. LEWIS (Sir, Bart.), The Mardy, Aberdare					431	77'75
EVAN JONES, Abernant, Aberdare					430	72'77
W. E. C. CURRE, Itton Court, Chepstow					390	54'59
*F. J. MITCHELL, Llanfrechfa Grange, Mon.					326	54'61
*E. TUDOR OWEN, Ash Hall, Cowbridge					315	54'99
*MORGAN LINDSAY (Lieut.-Col.), Ystrad Mynach					315	68'44
HENRY CLAY, Piercefield Park, Chepstow					310	47'13
WM. JONES, Reservoir, Pontypridd					300	71'58
GODFREY L. CLARK, Talygarn, Glam.... ..					250	70'65
J. WILLIAMS, Wern Boys' School, Ystalyfera					240	81'84
H. M. JACKSON (Sir, Bart.), Llantilio Court, Mon.					207	47'80
EDWIN C. POLE, Neath					204	61'81
H. HEYWOOD, Witla Court, Rumney, Cardiff					177	52'55
LORD LLANGATTOCK, The Hendre, Monmouth					176	37'68
C. H. PRIESTLEY, Llanishen Reservoir, Glam.					155	52'42
„ Lisvane					150	48'88
„ „Heath” Filters, Glam.					132	54'07
*O. H. JONES, Fonmon Castle, Glam.					130	41'89
C. H. PRIESTLEY, Cogan					121	51'80
FRANKLEN G. EVANS, F.R.A.S., Llwynarthan					72	49'42
C. H. PRIESTLEY, Ely					53	54'74
W. W. PETTIGREW, Roath Park, Cardiff					50	56'37
C. H. PRIESTLEY, Trade Street Depôt					45	51'96
*TORGORMAH REES, C.E., Porton, Goldcliff, nr. Newport, Mon.					27	36'80
JOHN D. ALEXANDER, M.D., Esplanade House, Porthcawl					—	47'78
*C. T. VACHELL, M.D.					—	—
*E. WALFORD, M.D.					—	—

* General Notes.

MAIN FEATURES OF THE MONTHS.

JANUARY.—The commencement of the month proved characteristic of the entire year—rainfall above the average, with mild temperature. Afterwards the weather was seasonably wintry, and skating became general for four days, but a period of unusual mildness followed, which continued with daily showers until the end of the month.

Maximum Temperature 53.8° on the 5th.

Minimum Temperature 21.6° on the 14th.

Mean daily range of Temperature 8.88° .

Frost registered in the screen on 10 days.

Hoar Frost on the 1st, 8th, 11th to 17th, and 23rd.

Fog on the 8th, 9th, 17th to 21st.

Ice on the 1st, 11th, 12th and 13th (1 in. thick) to 16th.

Snow on the 11th on the hills.

Thunder and Lightning 10.35 to 10.50 p.m. on the 3rd.

Dew on the 29th.

Humidity 88 per cent.

Total Rainfall on 24 days 5.34 inches.

FEBRUARY.—Mild and exceptionally calm weather during the first three weeks, in marked contrast with the same period a year ago. Snowdrop, Crocus, Polyanthus, Wallflower, and Gorse in blossom. Followed by high winds, which on the 26th amounted to a strong gale, doing considerable damage over the County.

Maximum Temperature 58.9° on the 19th.

Minimum Temperature 30° on the 18th.

Mean daily range of Temperature 9.66° .

Frost registered in the screen on 3 days.

Hoar Frost on the 2nd, 13th, and 18th.

Ice on the 2nd, 13th, and 18th.

Hail at 9.45 a.m. on 23rd, and 8.15 a.m. on 26th.
Lightning at 10.30 p.m., and Thunder at 11.45 on
the 25th.
Rainbows at 3.25 and 3.55 p.m. on the 28th.
Humidity 86 per cent.
Total Rainfall on 21 days 1.97 inches.

MARCH.—A month of mild temperature, high winds, and frequent showers, with a general absence of the proverbial March dust. Rainfall above the average. Wind generally Westerly to South-westerly. Fruit trees and hedge rows showing blossom and leaf.

Maximum Temperature 61.7° on the 22nd.
Minimum Temperature 33° on the 11th.
Mean daily range of Temperature 11.08°.
Hoar Frost on the 6th and 11th.
Dew on the 11th, 12th, and 13th.
Rainbows at 4.10 p.m. on 15th, 2.10 p.m. on the
26th, and on the 27th.
Humidity 81 per cent.
Total Rainfall on 25 days 5.24 inches.

APRIL.—Mild weather until the 12th, and vegetation everywhere forward. From the 12th to the 18th, Snow, Hail, Frost, and Ice caused disastrous effects to the blossoms of all fruit trees, and to garden and field crops.

Maximum Temperature 59.8° on the 28th.
Minimum Temperature 29.0° on the 18th.
Mean daily range of Temperature 14.64°.
Frost registered in the screen on 6 days.
Hoar Frost on the 14th, 16th, 17th, 18th, 20th, 24th,
and 25th.
Hail, 7.55 a.m. on the 13th.
Snow from 8.30 to 9 a.m. on the 13th, and 9.45 a.m.
on 15th.

Ice on the 14th, and 16th to 18th.

Dew on the 2nd, 3rd, 9th, 10th, 11th, and 13th.

Humidity 74 per cent.

Total Rainfall on 15 days 2.46 inches.

MAY.—Copious rains, with frequent thunder and lightning, the latter doing much damage locally on the 8th. In the 24 hours from 12.30 on the 8th to 12.30 p.m. on the 9th the rainfall measured 2.46 inches, equalling 246 tons to the acre.

Maximum Temperature 76.2° on the 31st.

Minimum Temperature 37.8° on the 19th.

Mean daily range of Temperature 15.08°.

Fog on the 1st.

Dew on the 16th, 18th to 25th, and 31st.

Hail 12 noon on the 6th, 11.20 a.m. to 1 p.m. on the 8th, and 4.35 p.m. on the 9th.

Thunder at 12 noon on the 1st, 3.45 to 4 p.m. on 4th, 10.0 a.m., noon, and 3.0 p.m. on the 5th, at noon on the 6th and 9th, and 1.15 p.m. on the 17th.

Thunder with Lightning on afternoon of the 1st, 11.20 a.m. to 1 p.m. on the 8th, 2.55 p.m. on the 27th, and 10.15 to 10.50 p.m. on the 29th.

Humidity 77 per cent.

Total Rainfall on 17 days, 5.54 inches.

JUNE.—The fine brilliant weather of the first few days was followed by cold winds and heavy rains, causing floods in many places, with East and North-easterly winds, and a low temperature. Mid-summer, however, gave us a change to bright hot summer weather, which continued till the close of the month.

Maximum Temperature 80.1° on the 27th.

Minimum Temperature 39.3° on the 22nd.

Mean daily range of Temperature 15.17°.

Dew on the 1st, 4th to 6th, 13th, 17th, 21st to 23rd, 27th and 30th.

Thunder at 12.40, 1.30, and 4.5 p.m., and from 5.0 to 6.0 p.m. on the 9th, at noon on the 10th, at 8 p.m. on the 13th, and on the 16th from 4.30 to 6.0 p.m.

Lightning on the 9th at 1.30 p.m., and from 5.0 to 6.0 p.m., and on the 13th at 8.0 p.m.

Humidity 75 per cent.

Total Rainfall on 11 days 2.67 inches.

JULY.—The first half of the month was bright, dry, and seasonable. Three consecutive weeks of favourable hay-making weather resulted in the crop of 1903 being well got and abundant. From the 15th to the end of the month rain almost daily.

Maximum Temperature 80.0° on the 10th.

Minimum Temperature 43.6° on the 8th.

Mean daily range of Temperature 16.29°.

Dew on the 1st, 2nd, 4th, 9th to 11th, 14th, 20th, 21st, 23rd, to 25th.

Thunder at 1.30 a.m. on 15th, 5.0 to 5.30 p.m. on 16th, 1.30 p.m. on 17th, 12.10 to 1.0 p.m. on 18th, 9.50 p.m. on 29th.

Lightning at 3.30 to 4.15 p.m. on the 17th, 12.10 to 1.0 p.m. on the 18th, 9.45 to 10.15 p.m. on the 25th, 9.50 to 12.0 p.m. on the 29th.

Hail at 12.10 p.m. on the 18th.

Humidity 75 per cent.

Total Rainfall on 20 days 4.01 inches.

AUGUST.—A few isolated summer days, otherwise the month was wet and disastrous to the corn harvest.

Maximum Temperature 71.9° on the 8th.

Minimum Temperature 44.7° on the 22nd.

Mean daily range of Temperature 13.77°.

Dew on the 5th to 8th, 11th to 13th, 19th, 21st to 23rd, and 26th.

Thunderstorms at 9.55 p.m. on the 11th, and 8.25 p.m. on 18th.

Thunder 1.50 to 3.30 p.m. on the 14th.

Humidity 78 per cent.

Total Rainfall on 21 days 5.32 inches.

SEPTEMBER.—With the exception of a week of fine dry weather in the middle of the month, September was wet, with terrific storms of wind and rain, that of the 10th being of hurricane force, uprooting a large number of trees in the district.

Maximum Temperature 70.1° on the 22nd.

Minimum Temperature 38.5° on the 16th.

Mean daily range of Temperature 13.34° .

Fog at 3 p.m. on the 2nd.

Dew on the 1st, 3rd, 4th, 6th, 7th, 10th, 12th to 19th, 21st, 23rd, 24th, 26th, 28th, and 30th.

Rainbow at 4.5 p.m. on the 9th.

Meteor 9.45 p.m. on the 17th, North.

Lightning 9.50 p.m. on 12th, 7.30 to 10.30 p.m. on 24th, and 8 to 11 p.m. on 26th.

Thunder 2.30 p.m. on 4th, 12 noon on 11th, and 11.30 p.m. on 24th.

Humidity 84 per cent.

Total Rainfall on 19 days 3.97 inches.

OCTOBER.—A month remarkable for heavy showers and excessive rainfall (rain having fallen every day except on the 17th). The quantity, 2.21 inches, which fell on the 15th constitutes a record at this station, the previous record being 1.92 on the 8th of May of this year. On the 16th, water was two to three feet in depth on the road by Roath Court, the Pengam stream having overflowed, and many country roads were under water.

Maximum Temperature 63.6° on the 6th.

Minimum Temperature 35.8° on the 24th.

Mean daily range of Temperature 10.38° .

Dew on the 1st, 10th, 18th, and 29th.

Rainbows at 1.5 p.m. on the 5th, 2.10 p.m. on 12th, 9.20 a.m. and 4.5 p.m. on 13th, 8.0 a.m. and 3.30 p.m. on 15th, 2.35 p.m. on 16th, 7.40 a.m. on 17th, 2.10, 2.40, 4.10 and 4.25 p.m. on 21st, 8.15 a.m. on 22nd, 11.30 a.m. on 23rd, 4.10 p.m. on 26th, 10.10 a.m., 1.40 and 2.20 p.m. on the 30th.

Hail at 9.5 a.m. and 9.20 p.m. on the 15th, and 11.25 a.m. on 16th.

Thunder at 12.15 and 12.50 p.m. on the 5th, 5.40 p.m. on the 12th, 5.15 p.m. and 8.30 p.m. on the 15th, 12.45 p.m. on the 16th.

Lightning at 5.40 p.m. on the 12th, 5.15 p.m. on the 15th, and on the 25th.

Humidity 86 per cent.

Total Rainfall on 30 days 9.84 inches.

NOVEMBER.—A magnetic storm of unusual force on the 1st played havoc with ordinary electrical currents, and interrupted communication by telephone for some time. According to the Rev. F. Sidgreaves, at Stonyhurst College, the disturbance began at 6.0 a.m. on October 31st, and lasted until 5.0 a.m. the following morning. Brilliant Aurora was visible in many places the same day. Rainfall below the average with many sunny days, and slight frosts during the second half of the month.

Maximum Temperature 55.3° on the 3rd.

Minimum Temperature 30° on the 19th.

Mean daily range of Temperature 10.29° .

Frost registered in the screen on 3 days.

Hoar Frost on the 4th to 6th, 15th to 17th, 19th, 25th, and 30th.

Dew on the 3rd.

Fog on the 5th.

Ice on the 19th and 30th.

Hail at 3.30 p.m. on the 14th.

Rainbows at 2.40 p.m. on the 14th, 4.0 p.m. on the 17th, and 11.0 a.m. on the 23rd.

Humidity 87 per cent.

Total Rainfall on 20 days 2.20 inches.

DECEMBER.—Seasonably cold during the first few days of the month, with ice on shallow water up to one inch in thickness. Mildness and humidity characterised the remainder of the year.

Maximum Temperature 51° on the 7th.

Minimum Temperature 25.1° on the 6th.

Mean daily range of Temperature 7.8° .

Frost registered in the screen on 10 days.

Hoar Frost on the 1st to 3rd, 5th, 6th, 12th, 25th, 27th, and 29th to 31st.

Fog on the 11th, 17th, 19th to 21st, and 23rd.

Ice on the 1st, $\frac{1}{2}$ in.; 2nd, 1 in.; 3rd, $1\frac{1}{2}$ in.; 5th, $1\frac{1}{8}$ in.; 6th, $\frac{3}{8}$ in.; 27th, $\frac{1}{8}$ in.; 29th, 30th, 1 in.; 31st, 2 in.

Rainbows at 12.40 on the 4th, 12.55 on the 7th, 10.50 on the 8th, 11.5 on the 9th, 10.30 on the 11th.

Humidity 89 per cent.

Total Rainfall on 21 days 3.99 inches.

TEMPERATURE.—STEPHENSON SCREEN RESULTS.

1903.				ABSOLUTE EXTREMES OF TEMPERATURE.			
				HIGHEST.		LOWEST.	
				Temp.	Date.	Temp.	Date.
January	...	...	...	53·8	5th	21·6	14th
February	...	...	...	58·9	19th	30·0	18th
March	...	...	...	61·7	22nd	33·0	11th
April	...	...	...	59·8	28th	29·0	18th
May	...	...	...	76·2	31st	37·8	19th
June	...	...	...	80·1	27th	39·3	22nd
July	...	...	...	80·0	10th	43·6	8th
August	...	...	...	71·9	8th	44·7	22nd
September	...	...	...	70·1	22nd	38·5	16th
October	...	...	...	63·6	6th	35·8	24th
November	...	...	...	55·3	3rd	30·0	19th
December	...	...	...	51·0	7th	25·1	6th
MEANS.				Highest 80·1	June 27th	Lowest 21·6	Jan. 14th
MEANS, 1902	...	...	...	Highest 79·2	June 28th	Lowest 20·5	Feb. 14th
MEANS, 1901	...	...	...	" 87·5	July 20th	" 20·8	Nov. 17th
MEANS, 1900	...	...	...	" 86·3	" 19th	" 20·8	Feb. 9th
MEANS, 1899	...	...	...	" 86·6	Aug. 24th	" 14·9	Dec. 15th
MEANS, 1898	...	...	...	" 81·4	Sept. 6th	" 26·4	Feb. 21st

All observations are taken at 9 a.m. Local and not Greenwich time.

DIRECTION OF THE WIND.

1903.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
January ...	6	—	7	—	3	2	13	—
February ...	1	—	2	—	3	1	21	—
March ...	1	—	1	—	10	2	14	3
April ...	12	2	6	—	3	—	7	—
May ...	2	2	16	—	1	2	8	—
June ...	3	6	13	—	2	2	4	—
July ...	6	—	1	—	7	—	16	1
August ...	1	—	2	—	3	3	20	2
September ...	1	—	13	—	6	1	7	2
October ...	3	—	1	—	9	5	13	—
November ...	5	—	4	—	4	1	15	1
December ...	5	5	11	—	4	—	6	—
TOTALS ...	46	15	77	0	55	19	144	9
TOTALS, 1902 ...	40	15	124	3	35	5	137	6

The direction of the wind is given according to true, and not magnetic bearings.

GENERAL NOTES.

The recent death of Mr. Franklen G. Evans leaves a vacancy in our ranks which all will deeply regret. From the inception of the Society in 1867, he devoted much time and energy to its welfare, inaugurating and directing this (Meteorological) Section with exceptional ability, and contributing, for many years, Reports of great merit, which will long be remembered.

I have again to express to all Observers the Society's appreciation of kind co-operation in collecting the Rainfall returns, and my own thanks for forwarding them to me.

Additional observations have been contributed from Dannel Hill, near Chepstow, by Mrs. Lysaght; from Storey Arms, Pentwyn Uchaf, and Trade Street depôt by Mr. Priestley; and from Roath Park by Mr. W. W. Pettigrew; while those at Cardiff Castle and Barry have been discontinued in consequence of the regrettable deaths of Mr. A. Pettigrew and Mr. James Bell.

The Royal Meteorological Society has been supplied as heretofore with the regular returns from my own station, and the results are printed in the "Meteorological Record."

Taking the Rainfall over the whole country, the past year, according to the tabulated returns of Dr. Mills, was considerably above the average, and the wettest, with the exception of 1872, that appears to have been recorded. London appears to have broken the record of 1879 by nearly 6 inches.

In the Society's district the excess above the average of the past 15 years is 19.69 inches, equalling 1,969 tons per acre. The rainfall of 4 inches at Porthcawl on the 27th of August is so remarkable that I ventured to question its accuracy, but Dr. Alexander assures me that it is absolutely correct.

The injury done to farm crops has fortunately been less than might have been anticipated, for although the Hay Crop was not so large as in 1902, the bulk was secured in better condition owing to the three weeks of glorious weather in June and the beginning of July.

According to "The Times" reports the average yield for the whole of England was about 30 cwt. per acre as against 31 cwt. in 1902, and 17 cwt. in 1901.

Wheat averaged about 30 bushels, Barley 35 bushels, and Oats 44 bushels per acre.

Fruit crops, with the exception of Strawberries which escaped the disastrous frosts and hail storms in the Spring, were a failure generally.

Mr. Torgormah Rees remarks that at Porton the strongest wind occurred on September 10th, when a heavy gale from the Sou-West exerted a pressure of 45 lbs. on the square foot, equal to a velocity of 96 miles an hour.

Mr. R. C. Harrison reports that the average Rainfall for the past 17 years at Gwernllwyn, Dowlais, is 50·20 inches, therefore his return for 1903 is 23·77 inches above the average.

Mr. Tudor Owen states that at Ash Hall, Cowbridge, the year's Rainfall was the heaviest since 1882, when 64·54 inches fell on 241 days, and also that it is 12·70 inches above his average for ten years.

Mr. F. J. Mitchell reports that at Llanfrechfa Grange there were four days in October on which an inch or more rain fell, and that the month's fall was only exceeded slightly in December, 1876, since the year 1865. A cold and wet year, out-door fruit being much injured and lost. More rain and a greater number of wet days than in any year since 1882. In only two years during the last thirty-nine has a monthly rainfall of 11 inches been exceeded, viz.:—September, 1866, 11·19 inches, and December, 1876, 11·64 inches.

Mr. O. H. Jones, of Fonmon Castle, remarks that the Rainfall was five inches above the average, and there were more wet days than he has ever recorded. The Rainfall for October was the heaviest that he has ever recorded in any single month, as also the number of wet days—28. The distinguishing features of the year were the persistence of the wet weather, and the absence of sunshine.

Lieutenant-Colonel Morgan Lindsay states that the Rainfall for the year at Ystrad Mynach was the highest he has ever recorded by over five inches, whilst the month of October was, so far as he could gather, a record for the district.

Dr. Charles Vachell reports from his observations taken at Park Place, Cardiff, that a temperature of 80° and upwards was recorded only on three days, viz.:—June 27th, 84°, July 10th, 83·7°, and on July 11th, 82·7°. He further adds that this is the fewest he has ever recorded.

Dr. Walford kindly sends the following report on the Public Health of Cardiff:—

During the year 1903 the influence of the meteorological conditions upon the Public Health has been favourable. The chief characteristics were the excessive Rainfall for the year—the amount being 55 inches, distributed over 256 days,—the comparative mildness of the first three months and the cool and wet summer. These conditions contributed towards the production of a low death-rate for the year, 13·9 per 1,000, the lowest rate on record. In the first quarter of the year the mortality from diseases of the respiratory organs was below the average, and in the third quarter there was an unusually small mortality from diarrhoeal disease.

The following table shows the relation between the mean temperature of the air, rainfall and diarrhoeal mortality during the third quarter of the ten years, 1894-1903.

Third Quarters, Year.	Diarrhoeal Death-Rate.	Mean Temperature.	Rainfall in inches.
1894	0·5	57·0	10·9
1895	2·5	59·5	9·9
1896	2·4	58·9	11·3
1897	2·6	59·3	14·3
1898	2·6	60·3	5·8
1899	3·2	63·3	5·3
1900	1·2	59·7	6·0
1901	1·4	60·2	11·1
1902	0·8	57·5	9·5
1903	1·2	56·9	14·7

RAINFALL IN THE DISTRICT, 1903.

	Feet above sea level	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Total.	No. of days with rain. "11 or more.	Greatest fall in one day.
Summit of Tyle Brith ... Average	2350	13-65	6-09	11-35	3-17	5-75	3-65	4-44	10-66	8-33	17-34	5-48	6-28	95-18	...	...
Mant Penig ... Average	2000	15-09	9-78	14-20	2-95	4-97	3-06	5-02	11-50	9-33	19-47	6-61	6-49	108-46	...	...
Storey Arms ... Average	1480	11-89	8-48	13-43	2-67	5-52	3-40	4-12	9-77	7-23	16-96	5-54	6-49	95-49	...	...
Beacons Reservoir ... Average	1340	15-42	10-65	15-91	3-51	5-59	2-95	5-13	12-09	8-70	19-43	6-80	7-48	113-16	285	{ 2-21 { Jan. 4th.
Pontlleust Wen Reservoir ... Average	1255	8-84	3-39	11-04	3-91	4-66	1-91	3-66	10-52	6-21	16-55	4-16	6-78	80-53	212	{ 2-50 { Oct. 14th.
Pentwyn Uchaf ... Average	1143	9-95	7-55	9-57	2-88	4-88	2-73	4-03	8-91	6-04	15-51	4-25	4-90	81-20	...	...
Ellesavon ... Average	1135	8-11	5-62	9-84	2-65	6-83	3-25	3-20	8-52	5-53	14-61	2-42	6-23	76-61	...	...
Cantref Reservoir ... Average	1120	12-04	8-23	12-35	3-31	5-59	2-26	4-63	9-75	6-73	17-65	4-92	6-29	93-74	259	{ 2-06 { Oct. 6th.
Dowlais ... Average	1084	8-33	5-46	9-35	2-67	4-72	2-73	2-45	8-18	6-23	15-99	2-66	5-31	73-97	240	{ 1-92 { Oct. 14th.
Treddegar ... Average	1084	9-90	6-24	12-11	3-07	5-58	2-94	2-66	8-97	6-07	16-08	3-16	6-05	83-08	219	{ 2-02 { Oct. 14th.
		5-26	4-01	4-36	3-67	3-32	2-93	3-55	5-15	3-59	5-81	6-26	8-39	56-31	176	

RAINFALL IN THE DISTRICT, 1903.

	Feet above sea level	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Total.	No. of days with rain, -01 or more.	Greatest fall in one day.
Glyncorrwg Average	717 ...	11.68 8.05	8.82 5.83	14.78 5.94	8.54 5.18	6.88 4.32	1.86 4.29	5.88 5.25	14.35 8.27	9.84 5.91	20.35 8.67	6.60 8.26	7.09 10.91	110.83 80.88	289 205	{ 2.70 Oct. 5th.
Bute Merthyr Average	670 ...	13.91 7.52	6.92 5.09	15.25 5.58	8.88 4.56	5.76 3.95	1.86 3.70	4.78 4.73	13.22 8.18	8.65 5.06	20.07 8.46	5.35 8.30	8.85 11.54	108.30 76.67	244 192	{ 2.87 Oct. 14th.
Llanfild Reservoir Average	582 ...	7.95 ...	3.74 ...	9.41 ...	3.26 ...	4.15 ...	2.15 ...	4.71 ...	11.17 ...	6.56 ...	16.61 ...	5.80 ...	6.46 ...	81.97 ...	201 ...	{ 2.10 Oct. 5th.
Chopstow Average	580 ...	4.23 ...	1.48 ...	4.09 ...	2.38 ...	4.21 ...	2.80 ...	2.47 ...	5.09 ...	3.65 ...	7.95 ...	1.99 ...	2.87 ...	43.31 ...	172 ...	{ 1.21 Oct. 4th.
Aberdare Average	431 ...	9.47 5.05	4.71 3.89	11.87 4.34	2.28 3.39	5.44 3.21	1.72 2.63	2.68 3.46	8.63 5.21	6.16 3.75	16.20 6.02	2.89 6.30	5.70 8.11	77.75 55.96	288 183	{ 2.32 Oct. 14th.
Aberdare Average	420 ...	9.08 5.25	4.83 4.01	11.38 4.61	1.98 2.87	3.70 2.96	0.80 2.29	1.87 3.11	8.56 4.58	6.04 3.57	14.95 5.76	3.20 5.73	6.48 8.38	79.77 53.12	177 154.5	{ 2.40 Oct. 15th.
Chopstow * Average	380 ...	5.56 3.21	2.40 2.47	5.60 2.21	2.65 2.26	4.04 2.24	2.77 2.32	4.04 2.48	6.39 4.16	4.46 2.88	10.42 4.31	2.48 3.52	3.78 4.48	54.59 36.54	219 171	{ 1.85 Oct. 15th.
Llanfrehfa Grange Average	326 ...	6.15 3.39	2.84 2.66	2.80 2.80	2.17 2.50	4.27 2.45	2.68 2.31	2.98 2.94	5.89 4.12	4.02 2.97	11.43 4.15	1.84 4.09	3.96 4.87	54.61 37.25	212 166.5	{ 2.25 Oct. 14th.
Cowbridge Average	315 ...	6.09 3.45	2.54 2.73	5.64 2.85	2.62 2.65	2.56 2.20	1.99 2.39	4.25 2.98	5.81 4.59	4.27 3.38	19.08 4.68	2.56 4.33	4.69 5.38	54.99 41.61	228 191	{ 2.09 Jan. 4th.
Ystrad Mynach Average	315 ...	8.56 ...	8.53 ...	8.90 ...	2.88 ...	5.00 ...	2.31 ...	3.51 ...	6.90 ...	4.31 ...	14.80 ...	2.56 ...	5.68 ...	68.44 ...	212 ...	{ 2.30 Oct. 14th.

RAINFALL IN THE DISTRICT, 1903.

	Feet above sea level	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Total.	No. of days with rain, -01 or more.	Greatest fall in one day.
Chapetow ...	310	5'35	2'09	5'04	2'68	3'83	2'50	2'99	5'11	3'25	9'55	1'79	2'96	47'13	185	1'53
Average	...	2'84	2'23	2'98	2'28	2'22	2'30	2'50	3'67	2'44	3'69	3'17	3'85	33'49	162	{ Oct. 4th.
Pontypridd Reservoir	300	8'33	3'95	9'96	1'61	3'77	1'63	3'95	8'87	6'87	14'46	2'88	5'32	71'58	198	1'98
* Average	...	5'28	4'03	3'36	3'44	2'60	2'91	2'90	5'64	4'30	6'17	5'55	7'26	53'44	157	{ Oct. 14th.
Talygarn ...	250	8'34	4'09	6'98	2'85	3'86	1'84	4'92	8'00	5'68	13'91	4'16	6'02	70'65	235	2'77
Average	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	{ Jan. 5th.
Ystalyfera ...	240	9'30	5'99	12'28	2'72	3'65	1'03	3'91	9'11	7'27	16'29	4'45	5'95	81'84	284	2'71
Average	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	{ Oct. 14th.
Llantilio Court ...	207	4'99	3'09	4'36	2'48	4'24	2'74	2'92	5'49	4'10	9'36	1'31	3'02	47'80	164	1'51
Average	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	{ Oct. 14th.
Heath ...	204	5'88	3'40	8'23	2'36	3'63	1'53	3'74	8'00	6'07	11'92	2'98	4'08	61'81	246	1'43
Average	...	4'14	3'09	2'99	2'95	2'57	2'77	3'52	5'21	3'33	5'40	4'67	5'67	46'31	196	{ Jan. 4th.
Bunnay, Cardiff ...	177	5'34	1'97	5'24	2'46	5'64	2'67	4'01	5'38	3'97	9'84	9'90	3'99	52'56	244	2'21
Average	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	{ Oct. 14th.
The Hendre, Monmouth	176	3'90	2'26	3'50	1'86	3'30	2'63	2'63	3'69	2'77	7'24	1'13	3'68	37'68	212	1'80
† Average	...	2'51	2'21	1'77	1'68	1'94	1'84	1'85	2'81	2'25	3'45	2'79	3'53	28'63	178	{ June 13th.
Llanishen Reservoir	155	5'21	1'81	4'99	2'14	5'13	2'37	4'19	5'61	3'86	11'06	2'94	3'82	52'42	230	2'16
Average	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	{ Oct. 14th.
Llswane ...	150	5'00	1'47	4'70	2'10	4'84	2'14	3'92	5'23	3'61	10'11	2'10	3'66	48'88	228	2'11
Average	...	2'85	2'29	2'27	2'16	1'91	2'05	2'65	3'84	2'63	3'79	3'34	4'13	33'91	179'5	{ May 8th.

RAINFALL IN THE DISTRICT, 1903.

	Feet above sea level	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Total.	No. of days with rain, or more.	Greatest fall in one day.
Heath Filters ... Average	122 ...	5.50 ...	2.33 ...	5.36 ...	2.32 ...	4.09 ...	2.03 ...	4.06 ...	5.76 ...	4.09 ...	11.31 ...	2.29 ...	4.25 ...	54.07 ...	214 ...	2.16 { Oct. 14th.
Fonmon Castle ... Average	180 ...	3.26 ...	1.81 ...	4.01 ...	1.98 ...	2.37 ...	2.03 ...	2.95 ...	4.45 ...	2.97 ...	9.24 ...	3.19 ...	3.63 ...	41.89 ...	204 ...	1.24 { Oct. 14th.
Cogan ... Average	121 ...	4.86 ...	2.09 ...	5.70 ...	2.63 ...	3.17 ...	2.25 ...	4.49 ...	5.85 ...	4.10 ...	10.31 ...	2.45 ...	3.90 ...	51.90 ...	238 ...	1.99 { Oct. 14th.
Llwynarthan ... Average	73 ...	5.18 ...	1.89 ...	4.88 ...	2.26 ...	4.88 ...	2.40 ...	3.91 ...	4.88 ...	4.02 ...	8.73 ...	2.85 ...	3.54 ...	49.42 ...	204 ...	2.13 { Oct. 14th.
Ely ... Average	53 ...	5.65 ...	2.51 ...	5.75 ...	2.32 ...	3.02 ...	2.09 ...	4.58 ...	6.00 ...	4.34 ...	11.37 ...	2.36 ...	4.75 ...	54.74 ...	238 ...	2.19 { Oct. 14th.
Boath Park ... Average	50 ...	6.46 ...	2.27 ...	5.70 ...	1.52 ...	4.98 ...	2.98 ...	4.15 ...	5.85 ...	4.51 ...	10.70 ...	2.71 ...	4.53 ...	56.37 ...	252 ...	2.16 { Oct. 15th.
Trade Street Depot ... Average	45 ...	5.25 ...	1.81 ...	5.30 ...	2.92 ...	2.63 ...	2.67 ...	5.40 ...	5.51 ...	3.83 ...	10.40 ...	2.22 ...	4.04 ...	51.96 ...	290 ...	2.20 { Oct. 14th.
Cardiff Castle ... Average	38 ...	2.94 ...	2.35 ...	2.51 ...	2.25 ...	2.03 ...	2.22 ...	2.97 ...	4.16 ...	3.08 ...	4.09 ...	3.66 ...	4.31 ...	36.57 ...	176 ...	... { Oct. 14th.
Porton (Mon.) ... Average	27 ...	3.43 ...	1.42 ...	3.73 ...	2.09 ...	3.67 ...	2.08 ...	3.05 ...	3.31 ...	2.82 ...	7.05 ...	1.54 ...	2.56 ...	36.80 ...	189 ...	1.32 { Oct. 14th.
Porthcawl ... Average	... ..	3.55 ...	2.56 ...	5.36 ...	2.16 ...	1.91 ...	2.55 ...	3.64 ...	10.26 ...	2.89 ...	7.21 ...	1.60 ...	4.09 ...	47.78 ...	241 ...	4.00 { Aug. 27th.

NOTE.—Average Rainfall is for the 16 years 1888-1902, unless otherwise indicated.

* 18 years—1890-1902.

† 11 years—1892-1902.



FRANKLEN G. EVANS, M.D.

1. The first step is to identify the problem or question that needs to be answered. This involves understanding the context and the specific requirements of the task.

FRANKLEN GEORGE EVANS, M.R.C.S.,
F.R.MET.SOC., F.R.A.S.

Born, 30 Oct., 1826; Died, 17 Jan., 1904.

BY C. T. VACHELL, M.D., AND PEPYAT EVANS,
B.C.L., M.A.

FRANKLEN GEORGE EVANS was not an original member of the Cardiff Naturalists' Society, probably because while actively engaged in general practice over a scattered country district he felt the difficulty of attending meetings; but it was inevitable that he should eventually join a body whose work appealed to him strongly. For many months before the formation of the Society he had devoted such leisure as he had to scientific work outside his profession, and had indeed forestalled the Society in what was necessarily its earliest mission—the endeavour to pave the way for more special work, by fostering in the public a taste for scientific knowledge, and by encouraging that systematic and habitual observation which is the basis of all scientific work. This he had done by means of signed articles on various scientific subjects contributed to the *Cardiff and Merthyr Guardian*. In particular he had published monthly and annual reports describing the character of the weather and giving summaries of the daily readings which he had begun recording at Tynant on January 1, 1866. To these he added, as was his custom, notes on the natural history of the district, and especially phenological observations. Some of his figures for the period from September, 1867 (the date of the formation of the Society), to August, 1868, appear at the end of Vol. i. of the Transactions.

In this connection two sentences may be quoted from a letter dated January 30, 1869, written to him by William Adams, the founder of the Society: "I wish you would join us, then instead of our *cribbing* your meteorology you could give it on your own account as a member. . . . Some members like you

B

must join, so as to get up what I much desire to see—a good Museum in Cardiff.”

Thus cordially invited, it is not surprising that later in the same year he joined a body with which he was so fully in sympathy. Once a member he threw himself heart and soul into its work, attending both evening and field meetings with a regularity which would have done credit even to a man of considerable leisure. To those who worked with him in those early days, the most striking points about him were perhaps his scientific ardour, his catholicity of taste, and his keen concern for the welfare of the Society.

These characteristics led him to devote study and thought to a great variety of subjects upon which he read papers before the Society (a list is appended) ; and also to speak briefly and lucidly in the discussions which followed the papers of others. In both respects he was performing an important service ; for a young Society must educate the public, awaking interest and winning recruits by slow degrees, avoiding the danger of specialising too much, or of forming “ sections ” too soon.

In conjunction with other members of the Society, and especially its President, William Adams, Franklen Evans helped forward the Fine Art and Industrial Exhibition of 1870, organized chiefly with the object of obtaining funds for the Museum, and largely successful both in attaining that object and in stimulating interest in Art, Science, and the applications of both.

The promotion of so energetic a member was naturally rapid. He was appointed a Vice-President in 1870, and in 1874 was elected President of the Society in succession to Mr. William Adams, delivering his presidential address at a Soirée given at the Town Hall, Cardiff, on February 2nd, 1875, by him and by Mrs. Franklen Evans—herself, until her early death, a member of the Society, and keenly interested in its success.

But however great his interest in other subjects, his devotion to meteorology was constant and unswerving ; and just as William Adams was the founder of the Society, so Franklen Evans was the founder of its meteorological department. For twenty-six years, beginning with 1869 and ending with 1896, he collected

and tabulated the rainfall returns from the observers throughout the Society's field, besides giving a detailed weather report and a summary of the other readings (barometer, temperature, humidity, wind direction, etc.), which he kept first at Tynant and afterwards at Llwynarthan, assisted by members of his family and household.

It is worth while to quote here a passage from the first of his annual reports, read February 3, 1870 :—

“In conclusion, gentlemen, I may be permitted to say that though this is my first report to the Society I trust that it may by no means be the last. Hitherto I have made observations as a lonely sparrow on the housetop, but my future *notes* will be as a member of a community with every variety of *note* and plumage. I shall no longer gather meteorological honey as a solitary specimen of the order Hymenoptera, but as a busy unit in this great industrious hive of working bees.”

For the first eight years or so he contributed to the Transactions not only the reports read annually before the Society, but written abstracts giving details of each month. As these appear in their order in print, and are indexed in Vol. xvii., the references are not repeated in the list which follows. Thus his detailed reports (including those published in the *Cardiff and Merthyr Guardian*) cover the time from January 1, 1866, to December 31, 1896, a period of thirty-one years. The record at Llwynarthan was continued until September, 1904.

It is worth while trying to trace the history of rainfall and other weather observations in the Society's field. That pioneer of systematic and uniform rainfall observation, G. J. Symons, began his series “British Rainfall” by the publication in 1862 of a thin volume dealing with the rainfall of 1860 and 1861. “British Rainfall” gives no return from our district for either of these years, nor yet for the year 1862.

But at this time two gauges had long existed in the Society's field, namely, that kept by Mr. Evan David at Fairwater (1824–1843, Trans. Vol. i. p. 45 ; 1844–1863, Trans. Vol. xv. p. 100), and by Mr. Edward David, first at Radyr Court and afterwards at The Hendre (1824–1843, Trans. Vol. xv. pp. 98, 102).

The interest and importance of these observations lies in the fact that they are the only records for the district before 1859. For purposes of comparison, it is true, the value of the Fairwater record is impaired by the fact that the receiving funnel of the gauge was at a height of 34 feet above the ground, and that it was on a "dumb chimney," the relation of which to the other buildings is not stated. Apparently also the graduation of the measuring tube was not tested either by an instrument-maker or by comparison with a standard gauge. But these were days when the importance of uniformity in such matters was not insisted on. As regards the Radyr Court and The Hendre record, the account in the Transactions does not state where the one set of observations ends and the other begins. But this omission could probably be supplied. In any case, the records are valuable, both from the length of time they cover and also from the fact that they are the only known observations in our district before 1859. They do not seem to have been published until they appeared in the Transactions (*loc. cit.*).

In 1859 began a record which still continues, and it may be hoped will continue indefinitely—that at the Ely Pumping Station of the Cardiff Waterworks. The annual total for 1865 appeared in "British Rainfall," but the earlier figures do not seem to have been printed until January, 1905.

In 1860 Mr. James G. Wood began his record at Chepstow.

For the years 1863 and 1864 the late Dr. Charles Vachell made rainfall observations in Charles Street, Cardiff. In this case also the position of the gauge was abnormal, no doubt from the exigencies of a confined situation, being in the former year 10 feet, in the latter 8 feet, above the ground. The annual totals were published in "British Rainfall."

From this time on, the multiplication of gauges in the eastern part of Glamorgan and the western part of Monmouthshire was continuous and rapid. Through the courtesy of Dr. H. R. Mill we are able to give the time when the following gauges began :

Those of E. W. Scale (Troedyrhiw), Dr. D. M. McCullough

(Abergavenny), and H. Soper (Blaina, Tredegar), in July, September and December, 1863, respectively. In January, 1864, those of the Rev. D. Charles, Abercarn, and of the Lisvane Reservoir (Cardiff Waterworks); though no readings of the latter appear to have been published until the total for 1866 appeared in "British Rainfall." In 1864, June, G. W. Nicholl, the Ham. In 1865, January, Messrs. Laybourne (Isca Foundry), F. J. Mitchell (Llanfrechfa Grange) and Henry Clay, junr. (Chepstow). Later in 1865 Phineas James (Ebbw Vale) and Robert Jordan (Sirhowy Iron Works). In 1866 H. G. Bowen, Springfield House, Cardiff; William Bowen, Tintern Abbey; Dr. T. J. Dyke, Merthyr; Franklen Evans, Tynant; and Evan Jones, Aberdare; also a gauge at the Town Hall, Cardiff. In 1867, January, S. R. Bosanquet, Dingestow. In 1868, April, William Adams. In 1869, January, W. T. Lewis, Aberdare. In 1869, June, W. T. Lewis, Treherbert.

This rapid increase in the number of gauges and observers is striking, and must be attributed to Symons's publications referred to above. Moreover, in the earlier sixties the same indefatigable worker was constantly communicating to the columns of *The Times* letters containing interesting particulars both as to details of rainfall observation (comparison of recent figures) and careful calculations of averages deduced from a long series of years. In these letters he was constantly urging the importance of preserving old rainfall registers, even if imperfect; of beginning new registers; and of sending in all available material for tabulation and publication (see especially *The Times*, December 23, 1864, May 16, 1865, and December 2, 1865. The letter of May 16 was reprinted and circulated).

There seems to be no good reason to doubt that it was Symons's enthusiasm and his persistence in calling public attention to his work that led so many, Franklen Evans among them, to become rainfall observers and recorders, the enthusiasm of these new workers bringing in turn further recruits to Symons's army.

The connection of the rainfall observations with the local

water supply is of such importance and general interest that this notice would be incomplete without some reference to it.

When the Cardiff Waterworks undertaking began in the early fifties there was no need for calculation of the supply to be expected from a given area : the water was pumped from the river at Ely through filter beds to the reservoirs at Penhill, and the population to be supplied was small.

When powers were obtained in 1860 for a new reservoir at Lisvane (constructed 1863) there was as yet very little material on which to base an estimate of the size of a reservoir, and at that time it may have been thought that the storage secured was so ample that precise calculation was unnecessary.

But in 1878, when the Llanishen scheme made it once more necessary to go to Parliament, the state of things was very different. At this time there were in the Society's field a number of gauges in various positions and various altitudes, and most of the registers had been kept continuously for ten years or more ; so that they afforded valuable information as to the amount and the distribution of rainfall in the district.

When the still larger Taff Fawr scheme of the Cardiff Corporation was before Parliament in 1884, G. J. Symons set himself to the difficult problem of estimating the rainfall on a gathering ground where no gauge existed or had existed, from the results given by surrounding gauges. Of these, thanks to the public spirit of observers and the organising work of Franklen Evans and others, there were several—mostly in the Society's field.

Later, when this scheme was carried out, science, which had given its aid to the practical engineer, now received a return from him in the shape of rainfall readings of great interest, as being from gauges at greater altitudes than any previously existing in the district—many of them purposely planted in positions calculated to throw light on the problems of rainfall distribution in relation to the configuration of the ground.

Only a word need be said as to Franklen Evans's work in astronomy. He did not become an observer until the early

eighties, when his miscellaneous contributions to the Society's meetings were becoming less frequent; and the chief result (so far as the public are concerned) of his taking up practical astronomy is that he eventually gave his telescope to the Borough of Cardiff.

CONTRIBUTIONS TO THE TRANSACTIONS

I.—MISCELLANEOUS.

<i>Subject :</i>	<i>Reference.</i> <i>vol. page.</i>	<i>Subject :</i>	<i>Reference.</i> <i>vol. page.</i>
1. Some Silicious Stones found in the Coal Measures . . .	ii. 55	9. Some of the present Inhabitants of Raglan Castle . . .	vi. 54
2. A White Substance found on Excavation in Cardiff Moors .	ii. 59	10. Llantwit Major and its Church .	vi. 76
3. The Carboniferous Limestone . .	iii. (1) 39	11. The Cardiff Naturalists' Society and its Work (Presidential Address) . . .	vi. 95
4. The Aurora Borealis . . .	iii. (1) 87	12. The Transit of Venus in 1874 .	vii. 88
5. Man's Relation to Nature . . .	iii. (2) 8	13. The Cheddar Caves . . .	ix. 67
6. Meteorology in Relation to Solar Physics .	iii. (2) 30	14. The Influence of Electric Light on Vegetation .	xiii. 33
7. Structural Botany No. 1 . . .	iii. (2) 33	15. The St. Nicholas Cromlechs . .	xiii. 41
8. Structural Botany No. 2 . . .	iv. 8		

II.—METEOROLOGICAL.

1867-1868. Observations . . .	i. 42	1882. Report . .	xiv. 104
1869. Report . . .	ii. 103	1883. " . .	xv. 107
1870. " . .	iii. (1) 83	1884. " . .	xvi. 68
1871. " . .	iii. (2) 81	1885. " . .	xvii. 120
1872. " . .	iv. 51	1886. " . .	xviii. 67
1873. " . .	v. 98	1887. " . .	xix. 78
1874. " . .	vi. 102	1888. " . .	xx. 78
1875. " . .	vii. 183	1889. " . .	xxi. 66
1876. " . .	viii. 157	1890. " . .	xxii. 75
1877. " . .	ix. 113	1891. " . .	xxiv. (1) 35
1878. " . .	x. 57	1892. " . .	xxv. (1) 47
1879. " . .	xi. 91	1893. " . .	xxvi. 18
1880. " . .	xii. 85	1894. " . .	xxvii. 13
1881. " . .	xiii. 101	1895. " . .	xxviii. 24
		1896. " . .	xxix. 18

IRISH BIOLOGICAL FUTILITIES.

ABSTRACT OF A PAPER READ TO THE BIOLOGICAL SECTION,
DEC. 10, 1903.

By R. DRANE, F.L.S.

WE, that is, Mr. Neale, two of his sons and myself, left Cardiff at the end of May to get such information as we might of the birds frequenting the West Coast of Ireland, its inland loughs and adjacent isles, and on the 31st found ourselves at Newport in Mayo, in the vicinity of which we found acres of *Erica mediterranea*, now nearly off bloom, some of it attaining a height of six feet; "St. Patrick's Cabbage," *Saxafraga umbrosa*, very abundant; *Salix pentandra* in bloom; "Rosydandrons," plentiful, in bloom, both planted and self-sown, and Fuchsias twelve feet high with stems six inches in diameter; *Erica ciliaris* and *Equisetum sylvaticum*. Thence we moved on to Achil Island, off the coast of which lies an island called The Bills, on which we expected to find seabirds breeding, of whom we had so far had no experience, but we found it disappointing—there was nothing new. On our way back we witnessed a sustained dissension between a guinea-fowl and a fine Dorking cock, and so tenacious was the smaller bird that the cock was wearied out and looked very crestfallen. Soon after leaving Achil Island we found our train "held up" by a company of cows chewing the cud between the rails, so that the stoker and driver had to descend to dislodge them. We were next at Ballinrobe as our headquarters for the investigation of Lough Carra and Lough Mask. On an island in Lough Mask we found a colony of Lesser Black-backed Gulls breeding. Here are the wings and feet of a dead gull for the verification of the species, and some of their eggs. Here we also found one of those pellets of the indigestible parts of their food, which so many birds eject from their mouths. It

was an elliptical mass of vegetable tissue, closely packed and spirally arranged, two and three-eighths of an inch long by one and an eighth in diameter, which Dr. Trow kindly examined and found to consist "almost wholly of grass, with a very insignificant quantity of adventitious matter." For what purpose had this bird eaten grass, whose natural food is fish and other animal matter? This pellet was elutriated, unwound and examined. It contained no vestige of animal origin. For what purpose, then, were its constituents swallowed by a bird who is not a vegetable feeder in the ordinary way? I would suggest, for the same reason that cats and dogs eat grass, pigs cinders, and hares sand—that is, "to scour their maws." The bird was unwell and could not eat, and took a dose of grass, as indicated by the entire absence of its natural, animal, food. The remarkably compact character and spiral formation of the pellet shows that a peristaltic action is as natural a function in this bird's maw as is that of our own stomachs. The grass, by a rotary motion, acted as a mechanical irritant, and so exciting energetic peristole that the suspended natural appetite was restored. It may here be objected that this is an instance of hasty but plausible conclusion, for there is no proof that this pellet was that of the gull. Good—but I would rejoin: that the diameter of the bird's gullet must have been greater than that of the ejected pellet. That diameter indicates a large bird. The large bird was here as the Lesser Black-backed Gull, which is known to throw up such pellets. Some of these ordinary pellets were found near the one we are discussing. We were on a small island, some way from the shore, where this gull was breeding, and there was no other large bird in the vicinity.

We were informed by our intelligent boatman that the Shag or Green Cormorant bred on a ruin upon one of the islands, and we saw the bird on the wing, but, visiting the indicated island in the confident expectation of finding its nest we were disappointed. The interest of this note lies in the fact that the authorities hold that this bird is wholly marine in its habits, never frequenting inland waters. Well, here we saw the bird, and intelligent men

always about the Lough affirmed that it breeds there, and the aforesaid island is fully fifteen miles from the nearest sea, and more nearly forty from the general coastline. The same authorities say that it breeds in colonies nearer the sea-level than the Cormorant, and that does not accord with our limited personal observations. We found it breeding solitarily on rocks on Skomer Island at a higher level than Cormorants in the vicinity. We saw it similarly alone on very high rocks on Ramsay Island, St. Bride's Bay. We found it alone on the very highest point of The Bills, West Coast of Ireland, and I have seen it on the coast of Kirkcudbright, Scotland, almost solitary, at no great distance from Cormorants in colony, and fully as high or higher on the cliffs than they. Here are five personal observations which seem to traverse the usually accepted assumption.

There is one other point to note. This bird has a pectinated or comb-like claw on each foot, which some suggest is provided to 'assist the bird in holding its slippery prey.' I cannot assent to this proposition. One might as well employ a pair of tweezers for securing a grampas. I have carefully examined several, and have never failed to find down firmly held in the teeth of this minute comb, which is proof of at least an obvious and natural use; while it is well to remember that other birds possess this pectinated claw whose habits are not aquatic and whose food is insectivorous; as, for instance, the Nightjar (more correctly, Night-chur).

On another island in this lough we found Terns breeding, and there, anent, arose again the question between us whether they were the Common or the Arctic Tern; and here also we were helped by finding a dead bird, whose remains are here as evidence. They are those of the Common Tern. An interesting question here presents itself. Terns and Gulls breed in large colonies. Their young in the season are thick upon the ground. They are all and always hungry. Their parents have to go some distance to take their natural fish-food, and are therefore long absent from their young. These young are constantly on the move, never in the same place long together. Do the parent

birds on their return indiscriminately feed the hungry young, or, if not, how do they distinguish their own, how find them even, amongst so many? We know that a shepherd knoweth his own sheep, and some can distinguish their sheep individually by expression of face or other personal peculiarity. We know that each ewe knows her own lamb, but they are always together, and so the difficulty of recognition is reduced. I would suggest that these birds have an acuteness of faculty unknown to us (civilization must be paid for and unused faculties are lost), remarkably illustrated in the instinct of some insects, by which they recognize their own under what to us are unconceivable conditions, and thus caution us to distrust the finality of our own limited faculties in their testimony upon questions of the utmost importance to our intellectual and moral being. Assuredly cats, or some other animals, have a limited faculty of seeing in the dark. What human being shall adequately estimate the delicacy of the dog's scent, which he shares with the sheep? A ewe dies and leaves helpless its dependent lamb. Another ewe loses her own lamb. The bereaved mother will not suckle the orphan lamb, but if the skin of her own lamb be put upon it she will adopt and nourish it. Be these things as they may, the bird, insect, dog and sheep exercise faculties unknown to us, and act on evidence unappreciable to us, just as the sensitised film responds to those rays of the spectrum of which our sight affords us no tittle of evidence.

On one of the islands we found the Wood Pigeon nesting in bushes so near the ground that standing on the general level we could look into their nests, which will seem improbable to those who are only familiar with its habits in English woods. The various species affecting these islands seemed to have localized habits, so that birds abundant on one will be wholly absent on one adjacent to it, each holding its undisputed domain. Other some, however, are cosmopolitan, as, for instance, the Common Sandpiper, in one nest of which we found the very unusual number of five eggs. In a large colony of Common Terns we found five nests of the Sandwich Tern. Truly the different

species of Tern are a happy family, neighbourly in a degree which might discredit their Christian fellow-creatures, and I would that they who know them not could see these exquisite birds upon the wing. They are the realization of perfect grace and unsullied beauty—bright spirits of the air who sanctify the earth by touching it. We found a brood of Wild Ducks only a few days old ; they tried to conceal themselves in the herbage, but instinct was too strong for them, and they betrayed their whereabouts by emitting the infinitely pretty call-note by which they keep together, so that one by one we caught them all. At first they were restless and very shy, but soon regarded us as friends, nestling in our hands, enjoying the warmth, illustrating the naturally inherent innocence of all created things, and speaking to us in syllables which angels use. Hereby we found one of the most beautiful of all British plants, St. Dabeoc's Heath, the *Menziesia polifolia*, found only in a limited area of this district.

We next visited Lough Mask, in whose highly mineralized water were innumerable "Jelly-fish" adhering to stones and plant stems. I sent some of them to Professor Parker, who tells me that they are the "*Ophrydium versatile*, a colonial peristrichous infusor, which builds for itself a house of jelly."

Nearing the end of our holiday we found ourselves on Aran Island, off the Galway coast—a veritable land of enchantments, where every square acre affords some object of absorbing interest. I know no district anywhere, not even those which include Rome and Athens, where there is so much within so small an area to arrest one's thought and stimulate imagination, but the exigencies of space forbid details. Here we found *Gentiana verna*, *Oxytropis uralensis*, *Cerastium arvense*, *Saxafraga caespitosa*, *Carduus narianus*, *Adiantum capillus veneris*, *Rubia peregrina*, the *polyporous* form of *Allium ampeloprasum* and *Cramb emaritima*.

We left Aran with infinite regret for Galway, where we saw salmon in hundreds lying side by side, a foot or so apart, in water eighteen inches deep, or less, waiting to enter Lough Corrib, where we left them, and came home.

ON PREHISTORIC HUMAN SKELETONS FOUND AT MERTHYR MAWR, GLA- MORGANSHIRE.

BY DAVID HEPBURN, M.D., F.R.S.E.,
PROFESSOR OF ANATOMY, UNIVERSITY COLLEGE, CARDIFF.
PAPER READ BEFORE THE ARCHÆOLOGICAL SECTION,
DECEMBER 16, 1904.

INTRODUCTION.

THE remains which form the material for the present communication consist of the more or less fragmentary skeletons of eight individuals, of whom two were children. These have been exhumed by Mr. William Riley, of Bridgend, in the course of a prolonged investigation of tumuli which had been exposed at Merthyr Mawr in consequence of the removal, during a severe gale, of the wind-blown sand by which they had been deeply buried and concealed from observation. Six of these skeletons were sent to me direct from Mr. Riley, and I owe the opportunity of examining the other two to the courtesy of Mr. Ward, curator of the Museum, Cardiff, in whose care they had been deposited. I desire to express my indebtedness to both of these gentlemen for their kindness in placing these interesting and valuable remains in my hands for anthropological examination. The archæological labours of Mr. Riley are well known, and it is entirely owing to his enthusiasm and disinterested public spirit that these records of a very ancient time have been unearthed and secured. In the midst of his busy commercial pursuits he has devoted much time, labour and money to a quest which requires all these aids for its successful accomplishment; and he is to be greatly complimented and congratulated on the fortunate results which have attended his

efforts. Not only in Wales, but everywhere, scientific workers owe him a debt of gratitude for what he has accomplished in his efforts to throw light upon the inhabitants of the land in that very remote period whose only human records are such as can be pieced together by a careful study of their inhumation customs and from the facts to be inferred from the examination of those parts of the skeleton which have survived centuries of entombment.

EARLY MAN.

The data which we possess for determining the presence of Early Man, and for discussing the conditions under which he lived, are, remains of his skeleton, with or without the associated bones of animals, wild or domesticated, weapons and implements of various kinds, vessels of sun-dried pottery, the product of his handiwork, and the nature of the tombs or cists which he constructed for the reception and protection of his dead.

An analysis of such data has established the belief that Man inhabited this land prior to what geologists call the First Glacial Period, or period of maximum glaciation. The remains of these Palaeolithic Men occurring in association with flint implements have usually been found in caverns side by side with the bones of non-domesticated and extinct animals. Caverns both in North and in South Wales have yielded human remains referred to this period, but "no trace of pottery which can without question be referred to Palaeolithic Men has been found."* According to the investigations of geologists, a second ice-sheet overflowed certain parts of the country; and where this happened, so far as Britain is concerned, there are no traces either of Palaeolithic Man or of the distinctive mammals with which his remains are associated.

Subsequent to the formation of the sea-beach which at present exists, the evidence of the presence of Man becomes more abundant, and now, for the first time, his remains are found associated with those of mammals, some of which are

* Sir William Turner, *Early Man in Scotland*, read to Royal Institution of Great Britain, March 26, 1897.

wild and some domesticated. This race of men is described as Neolithic. Their skeletons have been found in peat-mosses and barrows, and the anatomical evidence indicates that "Neolithic Man was of small stature, with a long oval skull." * They interred their dead in long barrows, which also contain weapons and implements made of stone. Sometimes they practised cremation, although they did not collect the burnt bones in urns.

The dolichocephalic character of their skulls was very pronounced, and according to observations recorded by Dr. Thurnam and Dr. Rolleston, the mean cephalic (i.e. length-breadth) index was 71.4 and 72.6 respectively, while the cranial height was greater than its breadth. The association of domesticated animals with Neolithic Man has led to much interesting speculation regarding the route by which these animals entered this country. It is believed that the Straits of Dover must either have been very much narrower than they are at present, or else non-existent at the time Neolithic Man and his belongings migrated into Britain, since it is not at all likely that he possessed any means of transporting live stock across a wide stretch of water.

These Neolithic inhabitants were in their turn overtaken by an immigration of people who used bronze in the construction of weapons and implements. Further, they were characterized by the short or round barrow or cist in which they interred their dead. The physical characters of the Bronze Men included a stature somewhat greater than that of Neolithic Man, and as a rule their skulls were brachycephalic, i.e., the length-breadth index was 80 or upwards, while the height of the cranium was less than its breadth. Occasionally a dolichocephalic skull occurs in a cist of Bronze Age, probably owing to the fact that the Bronze Men may have lived amicably among, and intermarried with, the Neolithic inhabitants of certain districts. Still, as a rule this admixture of dolichocephalic skulls with the remains of a brachycephalic people is not sufficiently pronounced

* Sir Arch. Gekie, *Text Book of Geology*, 3rd ed., p. 1064.

to negative the value of Dr. Thurnam's aphorism, "Long barrows, long skulls; short barrows, short skulls." In this connection some very unusual conditions are recorded in a recent paper on "Skulls from the Round Barrows of East Yorkshire, published in the *Journal of Anatomy and Physiology*, January, 1904, by Dr. Wright. These barrows are remarkable for the large number of dolichocephalic skulls found in them.

The author of the paper says: "Iron has never been found in these barrows; bronze has been occasionally and sparsely met with in a few of them," and "There is not the least vestige of evidence that Dr. Thurnam's dictum 'Round barrow, round skull' is even approximately accurate so far as the round barrows of East Yorkshire are concerned." Still, from the facts before him Dr. Wright concludes that these round barrows are either late Stone Age or early Bronze Age. Now, the peculiarity of the conditions may have been due to this very period of transition in which the Bronze Man was the dominant factor.

While the nature of the barrows and the characters of the skull provide a general distinction between the men of the Neolithic and Bronze periods, additional information may be found in the kind of weapons, implements, and utensils which are found in association with their skeletons. It is notable that the weapons and implements manufactured and used by Neolithic Man show "no material advance over the Palaeolithic Cave-dweller."* On the other hand, bronze makes its appearance for the first time in the round barrows or cists of the Bronze Age. It does not necessarily follow that bronze articles occur in every short cist, but they occur in a proportion of them. Urns, that is vessels made of sun-dried clay, of various sizes and shapes, also occur either external to, or in the interior of the cists. Those which are found near to, but on the outside of the cists, are regarded as cinerary urns, while those found within the cists never contain burnt bones, and may be classed as food urns.

The MATERIAL under present consideration was all in a more

* Turner, *loc. cit.*

or less fragmentary and fragile condition. Some parts of it were beyond reconstruction or restoration, but as a rule it was possible to determine the sex as well as the stature of the individual. None of the crania were sufficiently strong to warrant the risks of estimating their cubic capacity, and from the table of measurements it will be seen that a complete record of proportions was not always possible.

Mr. Ward had labelled the two skeletons from the Museum as B₁ and B₂, and acting on his suggestion the more recent adult skeletons were labelled C₁, C₂, C₃, C₄, and the young skeletons as 4a and 4b. Throughout the following description they are referred to by these numbers.

For uniformity of reference I may add that Mr. Riley has provided me with the following facts relative to the conditions under which each skeleton was found by him :—

"C₁, C₂, and C₃ were not in cists. C₁ and C₃ were associated with 'drinking cups,' and C₂ with an 'incense pot.' C₃ was 'encased in charcoal.' C₄ was found in a 'circular stone cist' without any pottery. B₁ and B₂ occupied a 'rectangular stone cist constructed on subsoil and under a circular tumulus 15 ft. in diameter and 5 ft. 6 in. in height,' and without any pottery. 4a and 4b also occupied a 'rectangular stone cist' without any pottery."

THE METHOD OF EXAMINATION.

As far as possible the cranioscopic and craniometric examination of the skulls and the examination of the other bones of the skeleton were conducted after the manner adopted by Sir William Turner in his "*Challenger*" Reports.* Special points in connection with long bones were considered on lines to which reference has been made in memoirs by Lehmann-Nitsche,† Manouvrier,‡ and the present writer.§

* "*Challenger*" Reports, part xxix., vol. x; and part xlvii., vol. xvi.

† Lehmann-Nitsche, *Beiträgen zur Anthropologie und Urgeschichte Bayerns*, band xi. 1894, heft 3 u. 4. München, 1895.

‡ Manouvrier, "Etude sur les variations morphologiques du corps du fémur dans l'espèce humaine" (*Bull. Soc. d'Anthrop. de Paris*, Oct., 1892).

§ Hepburn, *Jour. Anat. and Phys.*, vol. xxxi. pp. 116-157.

GENERAL APPEARANCES OF THE CRANIA.

C₁ was in a very shattered condition, and even after all attempts at reconstruction, many gaps remained in its continuity. C₂ was perforated in several places, and for the most part it was too thin to risk the estimation of its cubic capacity. A small interparietal Wormian bone, about the size of a shilling, was present at the posterior end of the sagittal suture. The base of C₃ was considerably damaged, but the supraorbital margins and superciliary ridges were remarkably well developed and preserved. C₄ was beyond satisfactory reconstruction, and the figures given in the table are only as nearly as possible exact.

DISCUSSION OF DETAILS.

I. The Skull.

Both the adult and young skulls were such as could be described as "well-filled," and C₂ and C₃ (in which the zygomatic arches were preserved) were cryptozygous. In all cases the skulls were well formed, and did not present any appearances of pathological deformity, although the young skull, 4b, bore evidence of distortion, probably produced by post-mortem softening and pressure, since the other bones of this skeleton did not suggest softening due to rickets.

The age of the skulls was estimated from the condition of the teeth and the cranial sutures. In the adult skulls the teeth were all considerably reduced by grinding, and except in C₄ the third molars, or wisdom teeth, were in position. In C₄ the wisdom teeth were not present: a number of teeth had fallen out during life, and those that remained were defective, worn and decayed. C₁ and C₂ were younger than C₃, which from the state of obliteration of the sutures was probably about fifty years of age. On the same grounds B₁ was probably above forty years of age. Of the young skulls judged by the teeth, which were all the temporary or milk set, 4a was under six years, and 4b about the same, while B₂, which possessed all the permanent teeth with the exception of the third molars, may be regarded as above twelve years and under eighteen years. The completely

ossified state of the epiphyses in C4 showed this to be an adult skeleton, while in B2 the state of the epiphyses showed the age to be about eighteen years.

The sex of the skull is not always easily determined, and when it is abraded and damaged by long inhumation this is naturally more difficult and uncertain. One relies upon the general configuration of the skull, especially in the frontal and supraorbital regions, recognizing the more strongly marked character of the ridges in the male than in the female, and the greater departure of the male skull from the infantile type of frontal region. Further, in the male the tympanic portion of the temporal bone projects more decidedly than in the female.

However, when other parts of the skeleton are present there is the possibility of determining the sex with certainty in various ways. For example, the subpubic arch may be reconstructed, and from its character all doubt as to the sex would be removed, since it is well recognized that in the male this arch presents a general "Gothic" appearance, whereas in the female it suggests the outline of the "Norman" arch. But work which has been done in recent years, notably by Dorsey,* of Chicago, upon the sex characters of the heads of the humerus and femur, makes it possible for us to be practically certain of the sex of a skeleton merely by reference to the size of the absolute diameter of the head of the humerus or head of the femur, irrespective of pelvic or cranial characters. Having these various methods of determining the sex, I have no hesitation in stating that the five adult skulls were all those of males, but as regards the three young skulls, there is not sufficient evidence upon which to determine their sex.

The cubic capacity of the skulls could not be determined with safety or certainty for the reasons already stated. From their general appearance they were of good average capacity, and did not suggest either high or low capacities.

* Dorsey, "A Sexual Study of the Size of the Articular Surfaces of the Long Bones in Aboriginal American Skeletons" (*Boston Medical and Surgical Journal*, July 22, 1897).

The CEPHALIC or length-breadth index was calculated upon the greatest glabello-occipital diameter and the greatest parieto-squamous width.* On the assumption that 100 represents a standard length, the breadth taken as a percentage of this gives the Cephalic Index. Upon this index skulls are classified as Dolichocephalic when the percentage of breadth to length is 75 or under; Mesocephalic 75 to 80; and Brachycephalic when above 80. From this it is clear that we may at least regard skulls as presenting two pronounced types, viz., Dolichocephalic, in which the proportionate length is the outstanding feature, and Brachycephalic, in which the proportionate breadth is markedly in evidence. There has been much discussion regarding the Mesocephalic or intermediate group, because it is evident that from 77·5 downwards the skulls approximate more and more to the dolichocephalic type, whereas from 77·5 upwards they just as steadily approach the recognized brachycephalic type.

The skulls under consideration were all markedly brachycephalic, the lowest cephalic index being 81·7, and the highest 86. The average cephalic index for seven skulls was 84·2, which indicates a very pronounced degree of brachycephaly.

The greatest glabello-occipital length was 184 mm. (in C4), and the greatest width was 153 mm. (also in C4). The shortest length, 166 mm., and the shortest width, 141 mm., also occurred in one skull (4a). In every case the basi-bregmatic height was less than the greatest width.

A comparison of the proportion of the height to the maximum length provides the Vertical or Altitudinal Index; and so far as the adult skulls were concerned each was Acrocephalic, that is to say, the height constituted 77 per cent. or upwards of the length.

I have recorded the various transverse diameters, and also the longitudinal, horizontal, and vertical-transverse circumferences and arcs, so far as they are available; but the number of these

* The working formula is:—

$$\frac{\text{Breadth} \times 100}{\text{Length}} = \text{Cephalic Index.}$$

measurements is not sufficiently great for the purpose of stating averages.

The GNATHIC INDEX, or index of facial projection was calculated in the usual way, and the requisite facts were available in four of the crania. Of these C₂ was mesognathous, and the others were orthognathous. From this we judge that the general outline of the faces of these people was very similar to that prevailing upon ourselves, and that they did not present the projecting jaws which are characteristic of African Negroes or aboriginal Australians.

The NASAL INDEX was calculated in two adult and two young skulls. In C₃ this index was 45·4, indicating Leptorhine nostrils, i.e. the high narrow character was pronounced. On the other hand, the index in the other three skulls was distinctly above 53, indicating a low, flattened and broad nasal aperture—Platyrrhine nostrils—such as characterize African Negroes and aboriginal Australians. This variation appears somewhat remarkable, but Broca and Turner have pointed out that the Nasal Index is more subject to the perturbing influence of individual variations than most of the other characters. In his "*Challenger*" Report, Turner records the extremes of Nasal Indices in a number of primitive races, and in summarising the results of his observations on Crania says: "The greatest variation was, however, in the facial, nasal, orbital, and palato-maxillary indices, in which the range was seldom below 10; in several groups the range of one or other of these indices rose to 20, and in two instances to upwards of 30." The range of the nasal index among the skulls under consideration was nearly 12.

Four ORBITAL INDICES gave one Microseme; two Meoseme; and one Megaseme, the extremes covering a range of 9·9.

Similarly, as regards the arching of the hard palate, there was a considerable amount of variation, the arch being shorter in the young skulls than in the adult skull C₂. (The figures given for C₃ are only approximate, and are therefore not suitable for comparison.)

The data for calculating the *DENTAL INDEX* were not suffi-

ciently complete. As regards the teeth themselves, in the adult skulls they were very well preserved, but their crowns were considerably reduced by grinding coarse or sandy food.

II. The Vertebral Column.

Numerous fragments of vertebræ were present with each skeleton, but in no case did they make a complete column, and only in C₂ and C₄ was it possible to collect a complete set of lumbar vertebræ.

Unfortunately these were so much broken that any attempt at calculating a lumbar curve was hopeless. In C₃ the second and third cervical vertebræ were ankylosed, probably as the result of chronic rheumatic disease affecting one of the intervertebral joint cavities.

In C₄ many of the vertebral bodies presented ossific deformities due to a similar cause. Portions of three Sacra were recognizable, but in neither case was there sufficient for detailed measurements.

III. The Limbs.

A LOWER LIMB.—1. *The Innominate bones* were damaged to such an extent that it was impossible to build up a pelvis. In C₁ and C₄ the presence of the subpubic arch was an aid in determining the sex.

2. *The Femora*.—As will be seen in Table II., six skeletons were represented by femora more or less fragmentary, but still available for certain measurements. The femora of the youngest skeletons, having lost all their epiphyses, were not measured.

The value of the femur as an aid to the recognition of sex has long been recognized, although until comparatively recently reliance was chiefly placed upon the angle formed between the neck and the shaft of the bone. The observations of Dorsey upon the absolute diameters of the head of the femur have shown that this measurement may be safely relied upon as a means of determining sex. As a result of extensive observations upon the femora of ancient American races (the sex of which

had been verified from the pelves), Dorsey found that the average diameter of the head of the male femur was 47·3 mm., while that of the female femur was 41 mm. He also found that it was extremely rare to get a male femur the diameter of whose head was less than 44 mm., or a female one of more than 44 mm.

Professor Dwight * gives 48 mm. as the average diameter for the head of the male femur, and 41 mm. as the average for the female.

Except among the femora of the Andamans, the present writer † has not found a male femur whose head was less than 40 mm. in diameter, while female femora are quite commonly below this figure.

Most of the femora under consideration were so seriously abraded that the exact diameter of the head could not be recorded, but even in their damaged condition their magnitude left no doubt regarding their sex, which in every instance was male.

In estimating the height of an individual from the total oblique length of the femur, it is customary to regard the femur as representing the ratio of 275 : 1,000, although this proportion is probably slightly more for tall men (i.e. 5 ft. 10 in. and upwards) and slightly less for short men (i.e. 5 ft. 1¼ in.). Since, therefore, 275 : 1,000 :: 1 : 3·636, if we multiply the total oblique length of the femur by 3·636 we obtain a good idea of the height of the individual. On this calculation the skeletons of the race represented in the present find were those of men of *moderate* height, i.e. they were above 5 ft. 5 in. and under 5 ft. 10 in.

Another, and probably more accurate method of calculating the stature is to follow the formula :—

Length of femur plus length of tibia × 2, plus 1 in. for absent soft parts.

On this basis the height of the present adult skeletons varied from 5 ft. 1 in. to 5 ft. 7 in., but as these bones are all somewhat

* Dwight, *Boston Medical and Surgical Journal*, July 22, 1897.

† Hepburn, "Femur," *loc. cit.*

abraded, this estimation is probably rather under than over the reality.

The Index of PLATYMERIE, which expresses flattening of the upper third of the femoral shaft, was very interesting. This character is a notable feature of Maori femora, as well as of many ancient femora. It is variously believed to be associated with a "squatting" attitude, and possibly also with hill-climbing habits. In the femora under consideration the average Platymeric index for eleven bones was 71·4, ranging from 62·5 to 76·4. This indicates very pronounced flattening, as may be seen from comparison with other femora.

Thus in 43 modern British femora I have recorded an average Platymeric index of 81·8. Among a few races I have recorded a lower average of Platymerie than that yielded by the present femora, e.g. Maoris, 63·6; Sandwich Islanders, 65·4; British (found near a Roman wall in Leicestershire), 67·7; and in Guanche femora, 70·7. As a rule, however, the index of Platymerie is much higher, and for modern Parisians and modern Frenchmen, Manouvrier states this index as 88 and 88·2 respectively.*

The PILASTRIC index obtained from the middle third of the shaft of the femur, i.e. the region of the pilastre or *linea aspera*, expresses the amount of backward extension of this section of the shaft in relation to its width. In this particular the femora under discussion were not so remarkable. The highest actual Pilastric index which I have hitherto recorded was 148 in an aboriginal Australian, and the lowest was 85·7 in a British femur, while the highest average index was 122·2 in aboriginal Australians, and the lowest average 95·5 in Sikhs.

In the nine femora of the present series available for this index the lowest is 88·4 and the highest 117·8, giving an average of 104·2, which practically corresponds with 104, my recorded figure for Malays, and is only slightly greater than figures quoted by Lehmann-Nitsche† for Ainos, Swiss, Feuerländer (Tierra del Fuego), and Bajuwaren.

* Manouvrier, *Revue mens.*, 1892 and 1893.

† Lehmann-Nitsche, *loc. cit.*

FIG. I.

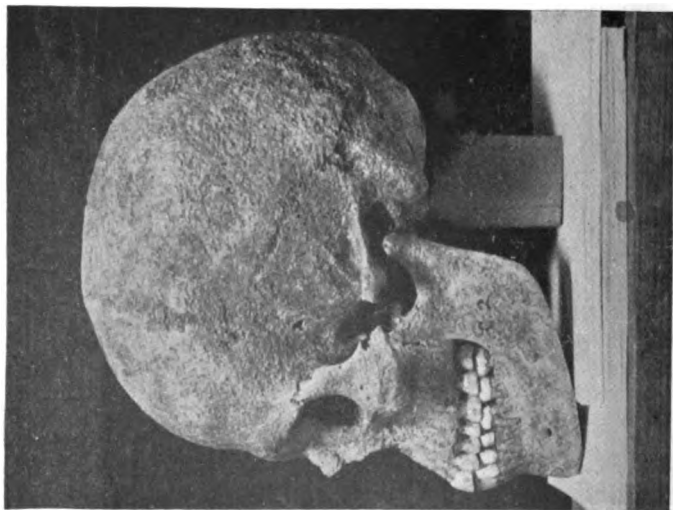
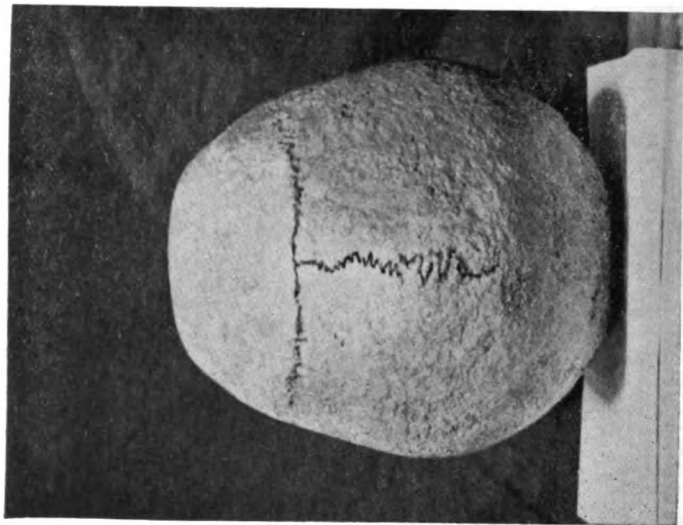


FIG. II.

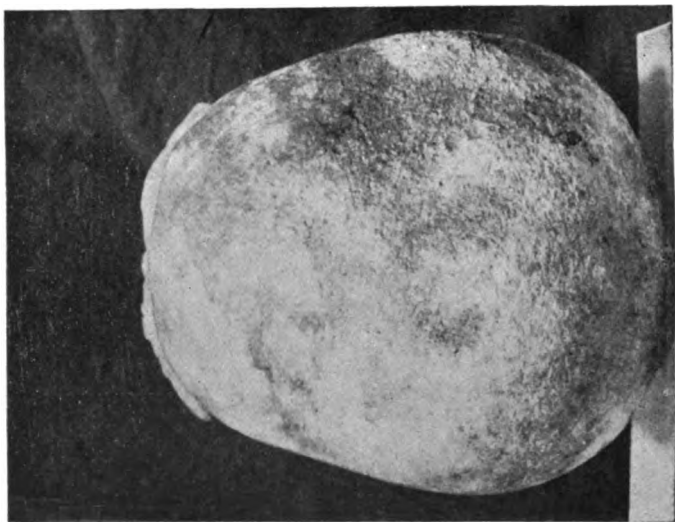


FIGS. I AND II.—Side view and vertex view of the same skull.

FIG. III.



FIG. IV.



FIGS. III AND IV.—Side view and vertex view of the same skull.

The POPLITEAL index could only be calculated in three of the femora, and therefore the figures are very limited.

The highest I have formerly measured was 96·9 in an aboriginal Australian, and the lowest 65 in a femur from near the Roman wall in Leicestershire, while the highest average of a large number of bones was 85·3 in aboriginal Australians and 70·9 in Laplanders.

The average of the present three is 78·7. As a low index indicates flattening or even concavity of the popliteal surface, and a high index expresses various degrees of convexity, whereby this portion of the femoral shaft approximates to the cylindrical contour characteristic of the Anthropoid form of femur, it is evident that the present femora were intermediate between the two extreme forms.

The general appearance of the femora may be summarised as follows :—

They were the femora from men of moderate height, and of well-developed muscularity, who systematically practised the “squatting” attitude, as is borne out by the pronounced *Platymerie* of the shafts; by the prolongation of the articular surface of the internal condyle to the popliteal surface (C₁); by the deep cupping of the overhanging margin of the acetabulum (C₂), with corresponding extension of the articular surface of the head of the femur to the front of the neck (C₄). In all respects the femora were distinctively human, and did not present any approximation to the more characteristic features of the Anthropoid femur. Thus, the condylar articular surfaces were in no sense Simian.

3. *The Patella*.—Four pairs of *Patellae* were present. They belonged to skeletons C₁, C₂, C₃ and C₄. Some of these were better preserved than the others, and in particular the right patella of C₁, and both patellae of C₃ were in a perfect condition. Its lower margin (C₁) was unusually pointed and prolonged. It has not been customary to record the measurements of this bone, probably from the fact that it ranks as a sesamoid bone, and is developed in the tendon of the

great extensor muscle of the thigh. Still, as its various diameters are correlated to the characters of the femoral condyles, besides being intimately associated with the position of the knee-joint in the customary attitude of the individual, it may be worth while to note its principal measurements.

	Maximum Width	Maximum Length	Maximum Thickness
Cr. (r) . .	44 mm.	49 mm.	20 mm.
C3 (r) . .	46 "	47 "	21 "
(l) . .	46 "	47 "	20 "
Homo (♂) . .	48 "	44 "	22 "
Homo (♂) . .	46 "	47 "	—
Homo (♀) . .	43 "	41 "	—
Gorilla (r) . .	43 "	37 "	18 "
Orang-utan (l). .	27 "	27 "	—
Chimpanzee . .	26 "	26 "	—
Gibbon . . .	14 "	18 "	—

With a sufficiently extended series of observations we should in all probability find some definite ratio between the maximum width and the greatest antero-posterior thickness, expressive of the degree of extension of the knee-joint associated with the customary attitude.

4. *The Tibia*.—The tibiae, like the other bones, were much abraded, but a variety of reliable measurements were obtained from them. They presented strong muscular ridges, and in those which possessed the lower end intact a well-defined "squatting" facet was visible, whereby this bone articulated with the upper surface of the neck of the astragalus. Table III gives the details of the measurements obtained. These were taken in the usual way. The index of *Platyknemia* was calculated at the level of the nutrient foramen.

Observations have shown that the index obtained from measurements taken at this level expresses the flattening of the shaft better than when taken lower down in the middle of the shaft. At the same time, in making comparisons with these indices it ought to be noted whether the measurements refer to

the level of the nutrient foramen or to the middle of the shaft, since there may be as much as 3 per cent. of difference between the indices obtained from the same bone at the two levels indicated. The indices given in Table III are all probably somewhat too high, except in the case of the left tibia of C3, because in all the tibiae, with the exception of the last-named, the anterior border of the shaft was somewhat damaged, and therefore the antero-posterior diameters are rather underestimated.

The amount of *Platyknemia* expressed by the indices enables us to classify the tibiae under consideration with other ancient bones in which this peculiar flattening is a marked characteristic.

In modern tibiae the transverse diameter is much greater in relation to the antero-posterior diameter, and the index is correspondingly higher, and it has been noted as high as 80° (Topinard).*

An attempt was made to determine the angles indicating retroversion of the head of the tibia and the inclination of its articular surface according to the method adopted by Lehmann-Nitsche.

The *angle of inclination* expresses the angle formed by the plane of the superior articular surface and a line prolonged from the centre of the inferior or astragaloid surface through the centre of the superior internal articular surface, while the *angle of retroversion* expresses the angle formed by the plane of the superior articular surface and a line passing vertically upwards through the centre of the shaft. The details of the procedure for constructing these angles is given by Lehmann-Nitsche. The angle of retroversion is of great importance in association with the squatting posture and the erect attitude, since it expresses the amount of backward displacement of the head of the tibia; and although it does not necessarily follow that individuals with a large angle of retroversion did not or could not adopt the erect attitude, it nevertheless proves that the semiflexed attitude of the

* Topinard, quoted by Lehmann-Nitsche, *loc. cit.*

knee-joint was the customary position, and that therefore the squatting posture and the shuffling gait with bent knees were much practised. Further, since completely extended hip and knee joints are essential features of the erect attitude, it is evident that large angles of retroversion and inclination indicate an arrangement more suitable for the semi-erect attitude.

The results of these measurements were very unsatisfactory, and while there is much to be said for the simplicity of the method, it is, so far as I am concerned quite unreliable, and anything like a constant result was quite impossible of attainment.

Both the retroversion and the inclination were observable by the unaided eye ; but in order that the angles may be precisely represented in degrees of a circle, it is essential that the method of ascertaining these angles shall give constant results.

A comparison between the length of the femur and the length of the tibia was possible in the four adult skeletons, viz. C1, C2, C3 and C4, and in the young skeleton B2.

This comparison is made for the purpose of representing the relative proportions of the thigh and the leg, and from it we obtain a *Femoro-tibial index* which is calculated on the assumption that the femur is 100. Thus,

$$\frac{\text{Tibial length} \times 100}{\text{Femoral length}} = \text{Femoro-tibial index.}$$

In the human lower limb, the thigh is always longer than the leg, although the relative length varies in different races.

In considering this index 83 is taken as the dividing line, and all *above* 83 are *dolicho-knemic*, i.e. the leg is long in proportion to the thigh, while all *below* 83 are *brachy-knemic*, i.e. the leg is short in proportion to the thigh. We may accept the general statement that Black races are dolicho-knemic, while White and Yellow races are brachy-knemic. The Femoro-tibial indices of the present skeletons are as follows : C1, 84.1 ; but as the femur was abraded, and therefore in reality rather longer than the figures obtainable, we may regard this index as unduly high. C2, 79.4 ; C3, 80 ; C4, 78.9 ; B2, 76. The average index

thus obtained was 79·6. For the sake of comparison it may be stated that the mean femoro-tibial index of Tasmanians is 85; Fuegians, 84·7; Negroes and Andamanese, 84; Aboriginal Australians, 83·3; Bushmen, 83; Esquimaux, 82; Europeans, 80·5; Chinese, 80; Lapps, 76. From this it will be seen that the skeletons under consideration were brachy-knemic, and therefore to be classed among White or Yellow races.

5. The Astragali in C₂ and C₃ were not so much abraded as in some of the other skeletons, and they were characterised by the well-marked facet upon the upper surface of the neck for articulation with the facet already referred to upon the lower end of the tibia, both of which facets occurring in the adult skeleton are conclusive evidences of the squatting posture, and probably also of a semi-erect and shuffling gait. Thus, at the hip, knee and ankle joints the lower limb was acutely flexed at least frequently if not at all times.

The other bones of the lower limbs were too fragmentary for detailed observations.

B. UPPER LIMB.—1. *Clavicles* were present, but without exception they were fragmentary and incomplete, so that no precise statement can be made regarding their absolute length, neither was it possible to compare the relative length of right with left. In five specimens the reduction was limited to more or less abrasion of their acromial ends, and noting the length of what remained, I find that C₁ (r) measured 147 mm.; C₂ (l), 142 mm.; C₃ (r), 151 mm.; C₄ (r), 144 mm., (l), 146 mm. From these imperfect figures it is fair to deduce that the mean length was greater than that recorded by Sir William Turner for male aboriginal Australians, viz. 142·2 mm., and for Sandwich Islanders, viz. 139 mm., while it was probably not much short of his recorded mean for male Scotch clavicles, viz. 150 mm., seeing that the mean for the fragments under our consideration was 146 mm.

In the case of C₁ and C₄ the left clavicle was straighter, i.e. less curved than the right, which was the more massive bone, and presented larger areas for muscular and ligamentous attachments.

The natural assumption is that these individuals were right-handed persons.

2. *Scapula*.—This bone was represented by fragments which were of no value for purposes of measurement.

3. *The Humerus* is of much value to the Anthropologist. Its total length, compared with the length of the radius, enables us to estimate the relative proportions of the upper arm to the forearm; and in man the rule is for the upper arm to be longer than the forearm. Apart from this use of the humerus, it has been determined in recent years, chiefly by the work of Dorsey that the head of the humerus presents an important sex character which is of the utmost value as an aid to the determination of the sex of a skeleton. Thus according to Dorsey the average maximum diameter of the head of the male humerus is 46.3 mm. and of the female 37.7 mm. We very rarely find a male humerus whose head is less than 44 mm. in diameter, and we practically never find a female humerus whose head is more than 43 mm. in diameter. Among the humeri in the present find, the head of C1 was 45 mm. in diameter; C2, even in its abraded condition, was 46 mm. and C3, 47 mm. These figures therefore provided valuable corroborative proof of the male sex of these skeletons and the same can be said of B1 and B2.

The total length of such bones as were fairly available for this measurement was as follows: C2 (l), 313 mm.; C3 (r), 331 mm.; (l), 330 mm.; C4 (r), 317 mm.; (l) 317 mm. B2 (r) 266 mm.

On account of slight abrasions, all these figures are somewhat understated. For this reason the Radio-humeral index in the three cases where it was possible to make the calculation is slightly higher than it would have been, supposing the humerus to have been undamaged. This index is calculated on the assumption that the humerus measures 100. Thus,

$$\frac{\text{Radial length} \times 100}{\text{Humeral length}} = \text{Humero-radial index.}$$

The higher the index, the longer is the forearm in proportion to the upper arm. The results obtained are tabulated as,

Long forearm (dolicho-kerkic) above 80, e.g.	{ Andamanese Fuegians.
Medium forearm (mesati-kerkic) ... 75-80	{ Aboriginal Australians, Negroes.
Short forearm (brachy-kerkic) ... below 75	{ Esquimaux, Lapps, Europeans.

The indices shown in Table IV being, as already stated, slightly higher than they ought to be, we may assume that their proper position is in the brachy-kerkic group, or, in other words, removed from the Black races.

None of the humeri presented either a supra-condyloid process or a supra-trochlear foramen.

In Table V there are such figures as were available for calculating the Femoro-humeral and the Intermembral indices. Unfortunately these figures are very imperfect. The object aimed at by these indices is to represent the relative proportions of the upper and lower limbs for the purpose of comparing them with the Anthropoid Apes, whose upper limbs are very long in proportion to their lower limbs. These indices are obtained from the following formulae :—

$$\frac{\text{Humeral length} \times 100}{\text{Femoral length}} = \text{Femoro-humeral index.}$$

$$\frac{(\text{Humerus} + \text{Radius}) \times 100}{(\text{Femur} + \text{Tibia})} = \text{Intermembral index.}$$

When these indices come above 100, as is usually the case among Anthropoid Apes, it expresses the fact that the upper limb is longer than the lower one.

Among human beings the upper limb is considerably shorter than the lower one, and therefore these indices are below 100. In the case of the Lapps, both of these indices approximate nearer to the Anthropoids than in either aboriginal Australians or Europeans. Thus, Sir Wm. Turner has recorded the following Intermembral Indices: Lapps, 72·8; Europeans, 69·5;

Australian aboriginals, 68·7 ; Chimpanzee, 104·6 ; Gorilla, 118 ; Orang-utan, 141.

From this it will be seen that the Intermembral Index of the limbs of C₃, viz. 69·9 and 69·1, places the present skeletons close to Europeans and far removed from the Anthropoid type.

No use could be made of the numerous fragments of bone which were present in addition to those that have been described.

CONCLUDING SUMMARY.

From this detailed examination of the various skeletons we have reliable evidence upon which we may with accuracy picture to ourselves these far-away inhabitants of our district. We see a race of *medium* stature, probably varying in height from 5ft. 1in. to 5ft. 7in. ; of well-developed muscularity and built in proportions similar to our own. Their heads were typically rounded ; their features well-defined and symmetrical ; their eyebrows strongly marked ; their noses well proportioned and probably not constructed with their apertures looking forward as in the Negro type. There is every reason for concluding that in colour they were white or yellow, and not black. In the relative proportions of their upper and lower limbs, they had advanced farther from the Anthropoid type than the Lapps, from which we may conclude that their mode of life was such as to develop the growth of the lower limbs to the same extent as our own. In other words, the land was their sphere of activity. Without doubt they constantly practised the squatting attitude, and preferred to sit upon their heels rather than to recline upon the ground. For this reason it is probable that their walking attitude was more or less semi-erect or crouching, rather than the free swinging gait which is our mode of progression, although there is no reason for supposing that they could not raise themselves to their full height when so inclined.

There is nothing in the proportions or size of their skulls to suggest that their skull capacity was less than that of similar modern skulls. Their burial places show that they had attained

FIG. V.



FIG. V.—Three femora, of which the two to the right of the reader are prehistoric and the one to the left of the reader is modern.

Platymerie is well shown in the case of the middle femur.

FIG. VI.

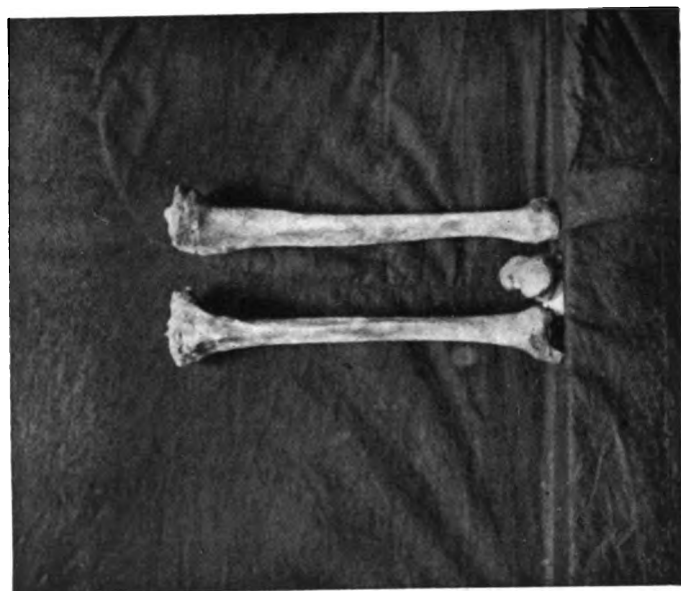


FIG. VI.—On the left hand, a front view of a prehistoric tibia; on the right hand a prehistoric tibia viewed from the inner side.

Intermediate between these the upper surface of an astragalus.

to a considerable recognition of social and moral obligations, while no small intelligence is evidenced in the construction of the cists in which their dead were inhumed and in the manufacturing of various weapons and utensils. The remains of their pottery show some idea of decorative effects, from which we may conclude that their ideas were not limited to mere utilitarianism.

It has long been recognized that skulls of a dolichocephalic type may be found in the round barrows, which are accepted as the specific form of tumulus constructed by the people whose skulls were brachycephalic in shape ; and in the course of this paper reference has been made to certain round barrows in East Yorkshire in which dolichocephalic skulls are said to preponderate, but I am not aware that any record exists of brachycephalic skulls occurring in the long barrows of the dolichocephalic people of Neolithic times. Further, from the fact that a certain percentage of round barrows do contain articles of bronze, it is the customary teaching to regard the round barrow and the brachycephalic skull as marking the dawn of the Bronze Age. At the same time it is difficult to understand why a capable and conquering people like those Bronze invaders could afford to lose the large number of bronze articles that may be collected on the sites of their encampments, and yet did not always bury some article of bronze along with the other weapons and implements inhumed with their dead. Of course bronze must have been both of considerable value and rarity in the first instance, but this would only be an additional reason for its inclusion in their cists. On the other hand, it is quite possible that the brachycephalic invaders were not provided with bronze when they arrived, that, in fact, they were themselves inhabitants of the Stone Age, using the weapons and implements of that period, and that after they had conquered, exterminated or merged their dolichocephalic predecessors with themselves, articles of bronze manufacture slowly followed in their track and became disseminated among them, displacing the rude stone implement and establishing the Age of Bronze.

The evidence obtained from the Anthropometric examination

D

of the skeletons described in this paper can only lead us to conclude that they present the physical characters of the men of the Bronze Age, while the entire absence of bronze from the barrows out of which these skeletons were obtained would lead one to associate them with the period of transition from the Age of Stone to that of Bronze.

TABLE I.
CRANIA.

Collection number	Cr. Ad.	C2. Ad.	C3. Ad.	4a. under 6 yrs.	4b. 6 yrs.	Br. Ad.	B2. 12 +	C4. Ad.
Age	♂	♂	♂	—	—	♂	—	♂
Sex	—	—	—	—	—	—	—	—
Cubic capacity	171	169	181	166	175	179	173	184
Glabello-occipital length	136	132	141	127	125	—	121	—
Basi-bregmatic height	79.5	78.1	77.9	76.5	71.4	—	69.9	—
<i>Vertical Index</i>	—	92	105	87	83	—	93	—
Minimum frontal diameter	—	120	126	114	115	—	118	—
Stephanic diameter	—	114	120	—	110	—	113	—
Asterionic diameter	147	143	152	141	143	154	143	153
Greatest parieto-squamous breadth	85.9	84.6	83.9	84.9	81.7	86	82.6	83.1
<i>Cephalic Index</i>	—	490	530	475	500	—	—	—
Horizontal circumference	127	119	—	128	134	—	115	—
Frontal longitudinal arc	134	123	—	134	137	—	119	—
Parietal " "	102	108	—	110	114	—	122	—
Occipital " "	363	350	370	372	385	—	356	—
Total " "	320	303	325	310	315	—	298	—
Vertical transverse " "	127	117	130	105	104	—	116	—
Basal transverse diameter	450	420	455	415	419	—	414	—
Vertical transverse circumference	38	33	39	30	35	—	35	35
Length of foramen magnum	97	95	104	82	84	—	92	—
Basi-nasal length	—	97	95	78	80	—	—	—
Basi-alveolar length	—	102.1	91.3	95.1	95.2	—	—	—
<i>Gnathic Index</i>	498	478	513	484	504	—	483	—
Total longitudinal circumference	—	—	—	105	—	—	—	—
Inter-zygomatic breadth	—	—	—	91	92	—	—	—
Inter-malar " "	—	110	124	84	86	—	—	—
Nasio-mental length	—	—	—	80	—	—	—	—
<i>Nasio-mental complete facial Index</i>	—	62	73	51	50	—	—	—
Nasio-alveolar length	—	—	—	48.5	—	—	—	—
<i>Maxillo-facial Index</i>	—	43	55	35	35	—	—	—
Nasal height	—	24	25	20	19	—	—	—
Nasal width	—	55.8	45.4	57.1	54.2	—	—	—
<i>Nasal Index</i>	—	38	39	31	32	—	—	—
Orbital width	—	28	35	29	27	—	—	—
Orbital height	—	73.6	89.7	93.5	84.3	—	—	—
<i>Orbital Index</i>	—	55	59	43	43	—	—	—
Palato-maxillary length	—	58	58	53	51	—	—	—
Palato-maxillary breadth	—	105.4	94	123.2	118.5	—	—	—
<i>Palato-maxillary Index</i>	—	—	—	—	—	—	—	—
<i>Lower jaw :</i>								
Symphysial height	35	30	32	—	24	—	—	30
Coronoid " "	65	60	61	—	42	—	—	69
Condylod " "	71	68	67	—	45	—	—	74
Gonio-symphysial length	94	92	88	—	65	—	—	—
Inter-gonial width	77	85	—	—	63	—	—	—
Breadth of ascending ramus	36	34	28	—	27	—	—	—

TABLE II.

FEMUR.

MERTHYR MAWR, GLAMORGANSHIRE.

Collection . .	Br. R.	B1. L.	B2. R.	B2. L.	Cr. R.	Cr. L.	C2. R.	C2. L.	C3. R.	C3. L.	C4. R.	C4. L.
Sex	♂	♂	♂	♂	♂	♂	♂	♂	♂	♂	♂	♂
Age	Ad.	Ad.	12 to 18 yrs.	12 to 18 yrs.	Ad.	Ad.	Ad.	Ad.	Ad.	Ad.	Ad.	Ad.
Total oblique length . .	—	—	388*	—	450	454	—	439	463	466	—	427
Diameter of femoral head .	—	—	—	—	46	—	—	—	52	52	48	47
Diams. of Subtrochanteric region :												
Antero-posterior . .	26	25	22	21	25	25	23	24	26	28	24	23
Transverse . .	37	37	29	28	40	39	32	33	34	37	34	34
Platymetric Index . .	70.2	67.5	75.8	75	62.5	—	71.8	72.7	76.4	75.6	70.5	67.6
Diameters of middle region of shaft :												
Antero-posterior . .	30	—	23	23	—	—	24	23	32	33	28	27
Transverse . .	29	—	22	22	—	—	25	26	28	28	26	26
Pilastic Index . .	103	—	104	104	—	—	96	88.4	114	117.8	107.6	103.8
Popliteal Index . .	—	—	—	—	76.1	—	—	—	79	81	—	—
(s) Popliteal width at 4 c.m.	—	—	—	—	42	—	—	—	43	43	—	—
(u) Max. bicondyl.loid width .	—	—	—	—	85	—	—	—	85	85	—	—
" = 100 ; $i \times 100$. .	—	—	—	—	49.4	—	—	—	50.5	50.5	—	—
Distance of linea aspera from external condyle . .	—	—	—	—	127	137	—	—	123	118	—	—
"mn." . .	—	—	—	—	32	—	—	—	35	36	—	—
"mp." . .	—	—	—	—	32	—	—	—	34	35	—	—

TABLE III.
THE TIBIA.

	Maximum Length	Shaft		Index of Platycknemia
		Antero-post diam.	Transverse diam.	
C1 * R.)	381	34	24	70.5
* L.)	382	34	25	73.5
C2. L.)	349	32	23	71.8
C3. * R.)	372	34	24	70.5
L.)	373	36	24	66.6
C4. R.)	339	35	21	60
L.)	337	33	20	60.6

* Bone somewhat abraded.

TABLE IV.

		Diameter of Head of Humerus	Total Length of Humerus	Total Length of Radius minus Styloid Process	Radio-humeral Index
C1.	R. }	45	—	255	—
	L. }	—	—	255	—
C2.	L.	46	313	—	—
C3.	R. }	47	331	251	75·8
	L. }	47	330	250	75·7
C4.	R. }	—	317	—	—
	L. }	—	317	—	—
B2.	R.	—	266	199	74·8

TABLE V.

	Femoral Length	Tibial Length	Humeral Length	Radial Length	Femoro- humeral Index	Inter- membral Index
C1. R. }	450	381	—	255	—	—
	L. }	454	—	255	—	—
C2. L.	439	349	313	—	71·3	—
C3. R. }	463	372	331	251	71·4	69·6
	L. }	466	330	250	70·8	69·1
C4. R. }	—	339	317	—	—	—
	L. }	427	317	—	74·	—
B2. R.	388	—	266	199	68·	—

“CALVARY” CROSSES, GLAMORGAN.

BY T. H. THOMAS, R.C.A.

(PAPER READ BEFORE THE ARCHÆOLOGICAL SECTION,
OCTOBER 21ST, 1904.)

I DO not know whether the matter I propose to bring before the section to-night is new, but I have not been able to find any notice of a class of ancient gravestones, of which many examples exist in our county. Stray notes upon certain slabs more or less similar I have found, but rather as relating to the persons buried beneath them than as specimens having a style of art (such as it is) and a type of symbolism all their own.

During several years I have made notes of gravestones occurring here and there in the churchyards and churches, for the most part in the Bro Morganwg or Vale of Glamorgan, which present as their chief feature a large standing cross generally upon three or more steps. The symbol is massive and little or not at all ornamented, and Latin in character. Many bear on either side of the massive tapering stem one or more quadrangular objects, which may be termed “billets.” The crosses and billets are in low-arched relief, the edges not sharp, but sinking into the ground, sometimes within borders, sometimes not, and the inscriptions, where they exist, are either incised in a space below the steps of the cross left for them, or are placed around the border of the stone. The border inscriptions are in Roman capital letters, those in the spaces below the crosses in mixed Roman and small print letters. All are of the sixteenth to seventeenth century, and my examples purport to give the following dates, 1608 (Hanmer), 1614 (Llantwit Major), 1615 (Ewenny), 1624, 1631 (Penmark), 1643 (Llanmaes), 1665 and 1695 (Trevethin), covering 87 years, that is to say, the earliest dated example (Hanmer) is of temp. James I, as are those of Llantwit Major, Ewenny, both at Llanmaes and Penmark, while the earliest date at Treve-

thin is temp. Charles II, and the next temp. William, Mary having died the previous year, 1694.

Notes of these slabs accumulated, and I now and then glanced at them with some curiosity and imagined that in the "billets" disposed on either side of the cross there might be seen a last survival of the disposition of the figures of the Virgin and St. John, or of two saints, such as has been common from the earliest ages, and examples of which in our district may be seen in monuments of the eighth or ninth centuries, as, for instance, upon the great Cross of Margam, and onward through the Middle Ages.

Another view was, however, forced upon me on a visit to Mr. T. C. Evans, more definitely known as the bard "Cadrawd," at Llangynwyd in the Maesteg Valley, and again on a visit to Laleston with our fellow-member, Mr. William Riley. At both these places exist slabs similar as to style, and therefore near to, if not within, the periods mentioned, but having designs of great interest, which appear to afford the prototype of which the "billet" slabs show the decadence. These designs show a Latin cross with stepped base, as in the examples already mentioned, but with the singularly interesting addition of two subsidiary crosses of the same pattern sprouting, as it were, from the central cross, one on either side. Another slab at margin showed a more decorated cross with, at each side, another of the same design, but smaller, and also mounted upon a stepped pedestal.

In these monuments it may be suggested that we have an explanation of the "billet" slabs, and fuller consideration of the latter will probably show the connection almost to demonstration. The whole series may, therefore, at least provisionally, be called "Calvary" Crosses or "Calvaries," as such groups are called in several continental countries.

This theory leads to speculation as to the earlier types of grouped crosses and, in result, I have prepared a series of diagrams (which are appended) having for object the tracing of the "Calvary" idea among the sepulchral monuments of our district.

Before applying the hypothesis to the less definite monuments

of an earlier age, we should consider how far the evidence of the sixteenth-seventeenth century slabs carries out the theory propounded—whether, that is, we can be convinced that the "billet" slabs are really descendant, or true variants, from those we have ventured to call "Calvaries." To do this we must take the specimens figured in detail.

And first let us examine the instances of triple crosses in Diagram II. K. and L., and D. III. M. and N.

Of these D. II. K. is apparently the earliest, as showing a more florid design, approaching the floreated crosses of earlier periods. It is at Margam.

It will be seen that the monument bears three crosses upon stepped bases, the central cross filling the panel of the stone, the other two, smaller, appearing below the arms of the central one, thus forming the "Calvary" arrangement. The central cross is placed upon two steps, the side crosses upon one. The floreated arms and head of these crosses have the style of fourteenth and early fifteenth centuries, while the massive shafts and limbs are of later style. As to the probability of the slab being later than it at first sight appears, a comparison with the design E (Diagram I), where a cross floreated and with open centre bears the date 1665, may make us believe that the ancient designs were copied, with or without modification, until the end of the seventeenth century. Another cross flory very similar to the instance at Trevethin is in the neighbourhood of that place—at Goytre, Mon., and is figured in Mr. Fowler's *Rambling Sketches*, has upon it the date 1684. A counter argument may be instituted by the suggestion that these dates, with their accompanying inscriptions, may have been inscribed upon cross-slabs already in the churches or churchyards. This habit was certainly common.

The three next examples are those which suggested to me the idea of writing these notes. They are of a very curious character, and consist of triple crosses, in which the central cross rises from a base of three, four, or five steps, while the side crosses, instead of being separate, branch out on either side of the main stem. All three stems are wide, though the central is

broadest. The heads of the crosses are square and plain. (D.2 L. and D. 3 M.N). Two of these are at Laleston and the third at Llangynwyd. Upon one of the Laleston slabs a portion of an inscription in Roman capital letters remains ; unfortunately it does not include the date. In the same example portions of two small Maltese crosses are seen above the arms of the great cross, and at Llangynwyd small square spaces below the arms formed by the touching of the cross-bars and stem are similarly decorated. Other ornament there is none. The Llangynwyd slab tapers from the base to a narrower head, thus reversing the arrangement upon early slabs.

In these very strange designs we must certainly admit that we see, however curiously modified, the crosses of Calvary, which we have already found in the Margam slab, although we no longer find each cross placed upon its own separate base. The added number of steps also reminds us of the mount, especially when we observe in the Llangynwyd instance that the steps have lost their regular form, and might even typify rocks or other irregularities.

It should be observed that neither of our typical Calvary slabs are dated. That at Laleston was formerly dated, but only the beginning of its inscription remains, being a few words incised in Roman letters along the stem of the central cross. Thus we have no means of dating these most important examples further than by their style, which is Renaissance, or at least transitional, all the forms, and especially the lettering, being characteristic of the late Tudor and seventeenth century periods.

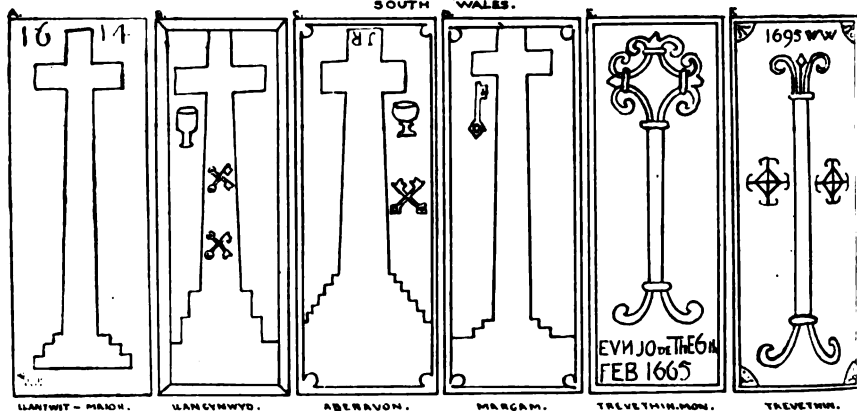
Other ornaments or symbols are occasionally seen. Upon single crosses we have at Margam a single key in the field ; at Aberavon two keys crossed in saltire and a chalice also in the field ; at Llangynwyd a chalice in the field and two saltires of keys upon the shaft of the cross. These refer the monuments to pre-Reformation times. Upon "billeted" slabs we find certain decorations : upon the base of the centre cross an archway, possibly the entrance of the tomb or the outflow of the River of Life, at Margam ; three raised bars, probably steps, also occur at

Margam. Many of these "billeted" slabs have a large space left in the base for inscriptions, which have been generally erased, but one long and rather peculiar epitaph exists at Penmark which I have not found it practicable to include in my diagram, but add it here. It runs as follows: "Sacrum memoria. Here lyeth the body | of James Matthes of Roose Esq who | deceased the 18 day of March A.O. | D.M.O. 1631 and in yeare of his | age 33 who married Elizabeth | Dau of Eduard Van of | Marcrosse esq^r and had by | her 3 sonnes John and William | who died young and Edward | a yong infant now lyving." These are well-known local family names, and to them may be added that of Adam Nicoll 1615 at Ewenny, and the names inscribed upon two fragments at Llanmaes of John Shirrey and Edward Turberville, 1624 and 1643 respectively. The two last are probably added years after the cross was carved, as the lettering of one sprawls across the top of the cross, and, as well as the other, is carved contrary to the standing of the cross, giving the idea of an ignorant misappropriation of an earlier monument.

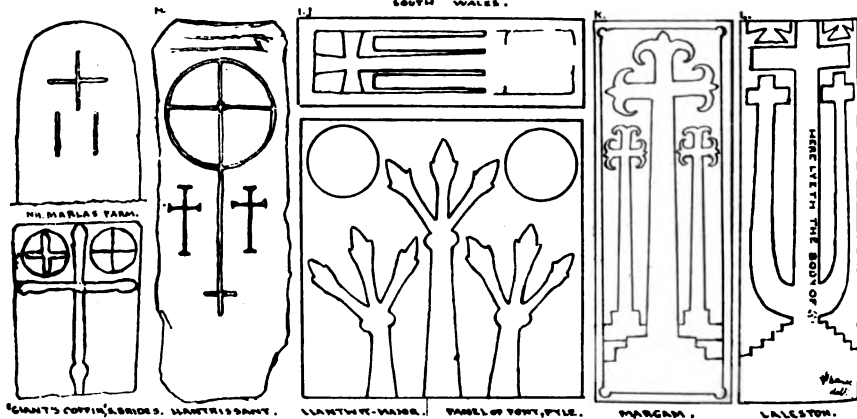
We now come to the question of the "billets." Are these survivals of the second and third crosses of a "Calvary"? The essential of a "Calvary" seems to be that the crosses shall be three, and that they shall be planted in a base, or be earthfast, in contra-distinction to such crosses as are laid upon the monument without any base, and might be considered to be symbolic of processional crosses. We have, therefore, to show from our examples that the "billets" indicate their modification from such a planted cross.

Among my figures is one which should have had a more important place than I have given it (D. II. 1). It is from Llantwit Major church. Here we see a Latin cross, with the upper limbs pattée, set into the ground without steps, at each side a "billet" or pole, also earthfast. So far we find our "billets" to represent at least a fixed pole or "tree." Now turn to the example from Hanmer, in North Wales. Here we find a cross of curious form, the head having a pine-cone orna-

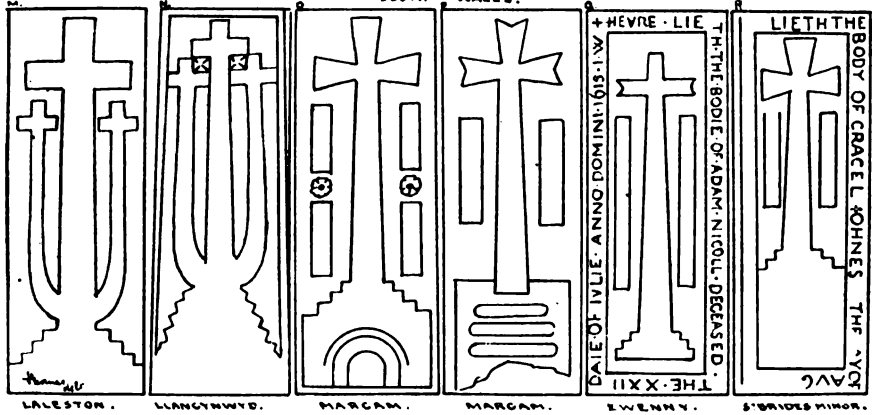
"CALVARY" CROSSES. DIAGRAM I
SOUTH WALES.



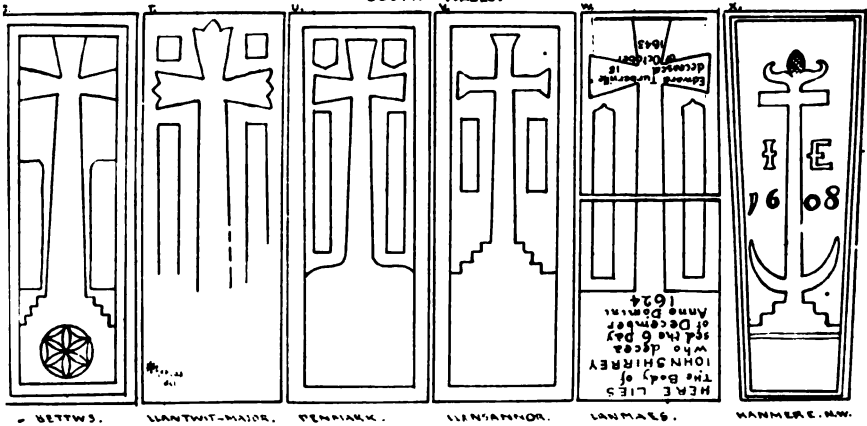
"CALVARY" CROSSES. DIAGRAM II.
SOUTH WALES.



"CALVARY" CROSSES. DIAGRAM III.
SOUTH WALES.



"CALVARY" CROSSES. DIAGRAM IV.
SOUTH WALES.



ment. It is fixed into steps. From just above the base arise on each side a bent ascending branch, in which we can hardly fail to recognize a survival of the two side crosses such as we see in the Llangynwyd and Laleston "Calvaries" (D. III. M.N., D.II. L). The Hanmer example I take from *Dineley's Progress* 1684. The account states that the monument is erected to a mariner, and that the object is an anchor, which it much resembles. Yet, in spite of this almost contemporary evidence, we may connect the slab with our examples of "Calvaries."

For Dineley writes as follows: "The north isle of Hanmer church carrieth in the middle thereof this Tomb stone said to be of John Eddon of Fibrawhan in the county Flint whose estate was named Brenhouse. I suppose him to hv raysed himself by navigaōn because of the device having some semblance of an anchor." It will be seen that Dineley only expresses his conjecture.

To return to our "billets." We have seen from our Llantwit Major example that they arose from the ground or base; from that at Hanmer that they were affixed to the bottom of the central cross, and it seems that we can scarcely be wrong in identifying them with side crosses. But it may be said in reply that some indication should remain which would indicate in however slight a manner a reminiscence of the most important part of a cross, namely the head. Here we fail to satisfy the objector; in no instance which has come before us do we find anything of the kind.

We may describe the variants of the "billets." There is first the simple pole planted in the base at Llantwit Major; then the tapering ascending branches of Hanmer; further we have simple poles of considerable length at Ewenny (D. III. Q) and Penmark (D IV. v.) lying free in the field. Then we have much shorter "billets" as at Llansannor, Margam, and St. Brides Minor, where very short "billets" flank the central crosses. At Bettws the "billets" are attached to the border of the slab (D. IV. s), and at Margam there are four billets, two on each side, with a rose between each pair (D. III. o.) It will be

noted that in D. IV. T.U. the spaces above the arms are filled in the one case with squares, in the other with small escutcheons.

What is the period of the monuments? This seems to me in many cases a difficult question. In Brecon Priory simple Latin crosses existed upon slabs bearing inscriptions in the old English letter; another having Lombardic lettering according to Dineley who gives drawings of them (*Dineley, Progress*, p. 204); they are to Morgan ap . . . Thomas, and to Johanes Hyllle respectively. A floreated cross upon three steps also ornamented a slab to Llewelin ap Howel in the same church.

In the examples upon the diagrams we can feel upon safe ground only in regard to the date 1608 at Hanmer, that of 1615 at Ewenny and 1631 at Penmark. These slabs have the design and lettering properly ordered and homogeneous. Certain letters on the branched Calvary at Laleston and the dated inscriptions on the broken slab at Lanmaes appear to have been later adoptions. The date 1614 upon the single cross at Llantwit seems genuine. The two crosses from Trevechin afford a puzzle. (D.I.E.F.) The floreate cross certainly looks of older style in all respects than the huddled, badly disposed inscription, of 1665 below it, and it may be questioned whether cross and date are contemporaneous. But we may admit the curious degradation of a cross, dated 1665, because of its degradation.

It may be remembered that the great Order for the destruction of "crucifixes, crosses and all images of any one or more Persons of the Trinity" was promulgated in 1643. This was followed in 1644 by other Orders of the same nature. But the destruction commenced earlier, and many slabs may have been removed and, becoming lumber, may have been adopted when the pressure of the Acts was over, by the stone-cutters, and seventeenth-century names cut upon sixteenth-century or even earlier stones.

It may be noted that the defacement of one of the slabs at Llanmaes gives the date of the decease as 1643, the year of the great Order.

Bloxham in his *Companion to Gothic Architecture* refers to this

and figures a curious rose-cross of 1669 at Llanbedr (county not stated). He says "Notwithstanding the diatribes against crosses in the middle of the seventeenth century . . . flat sepulchre slabs with crosses thereon of a peculiar description are found, not unfrequently, both in churches and churchyards." If I can judge from examples I have seen engraved, it seems that in all these the emblem is much confused, and its use might be extenuated as being, not a cross, but a rose or flower. This idea occurs to me owing to my own experience in relation to these two examples. They are in the churchyard of the parish where I was born, and as children of the village we often went to see them, but they were never recognized as crosses by us. We always knew them as "flower-de-luces."

The diagrams have a number of figures of an earlier date than those we have dealt with, just to remind us that the three crosses had been long used in a different manner. On the giant's coffin, so called, at St. Bride's is a cross with two others above the upper arms. On the panels of the Font at Pyle is a very interesting device which seems a true Calvary: it seems early fourteenth century. At Llantrissant is a crossed slab with a circled cross, on either side of the stem of which are crosslets. This, Mr. Romilly Allen thinks, may be pre-Norman. Near the Marlas Farm below Bridgend is a crossed stone of uncertain age, with below it two vertical lines, in which we may possibly find an origin for our "billets."

In conclusion I would like to ask for aid in carrying on a collection of our Welsh crosses, so as to get all evidence possible upon the subject of this paper. It would be extremely interesting to find whence these designs came. Do they occur as commonly in other districts? Were there formerly any built Calvaries such as we find on the Continent, and, if so, do any remains exist of them? Such are the questions which arise.

I should add that my diagrams give only the information necessary for my paper, and are not to scale, nor do they give details of borders or moulding where such exist. The size of the slabs is, generally speaking, from five to six feet long; a few

taper in shape. There is also a class of small slabs about two-thirds of the usual dimensions.

CHRONOLOGY.

Henry VIII.	. . . . .	1509-1547
Edward VI		1547-1553
Elizabeth		1558-1603
James I		1603-1662
Charles I	(beheaded)	1625-1649
Charles II de jure	1649, a. 1660	
Republic		1649
Cromwell		1656-1658
Rd. Cromwell	resigned	1659
Charles II		1660 Feb. 1685
James II		1685 fled 1688
William and Mary, Feb. 1689.	Mary died Dec. 1694	
	William died	1702

ORNITHOLOGICAL NOTES

FOR 1904.

BY T. W. PROGER AND D. R. PATERSON.

Slavonian or Horned Grebe. *Podiceps auritus.* On February 2, a bird of this species, a male, and of course in its winter plumage, was shot on Lisvane Reservoir. This is a northern species, breeding in Iceland, Scandinavia and Russia, and appears only in this country when on migration. Howard Saunders says that it is an annual visitor to the coast of Wales in small numbers. In this immediate locality the Slavonian Grebe has only been recorded on two occasions previously, viz., in January, 1885, and January, 1887, but Sir John Llewelyn says that this bird visits Penllergaer regularly in October.*

In April, the adult male assumes his full breeding plumage, which differs greatly from the winter dress. At this time a tuft of pale chestnut feathers appears on each side of the head, with a black tippet and crest, and the upper parts of the neck and breast assume a ruddy chestnut colour. This bird is now to be seen in the collection of local birds in the Welsh Museum, Cardiff, along with another of the same species, shot at Tenby some few years ago.

Common Buzzard. *Buteo vulgaris.* On October 30, one of these birds was shot at Dinas Powis, at the head of Cwm George, as it was thought that it destroyed the pheasants in the preserves. It is a mistake to suppose that this handsome bird is destructive to game. Its food consists mainly of field-mice, moles, and other small mammals, also frogs and grasshoppers. We examined the contents of the crops of two of these birds not

* *Birds of Glamorgan.*

long ago, and found the remains of a rat in one, and a water rail in the other ; young rabbits also form part of its diet.

Great Crested Grebe. *Podiceps cristatus*. During the early days of January, 1905, this bird paid a visit to the lake at Roath Park for the first time, where it created much interest, and afforded the rare opportunity of studying its habits at fairly close quarters. This bird was seen to catch and swallow a few small fish, which are supposed to be the young trout that had been turned into the lake. This was more than the Park Authorities—who had the fishing interest very much at heart—could tolerate, so the bird was ordered to be destroyed. Fortunately this order was not carried out, but the poor bird was so much harassed by men in boats sculling after it, that it soon flew away, and has not been seen since. The Great Crested Grebe is more or less resident on some of the larger lakes in Wales and England, and sometimes nests on one or two private sheets of water in this county. It feeds on young eels and other small fish, frogs, tadpoles, and crustaceans. In spring the adult male assumes a handsome crest and tippet, which gives the bird a strange aspect : the crest and tippet of the female is not so large as in the male. The young, when in the down, have a very curious stripped appearance ; they also have a small circular bare patch on the crown of the head, which has not yet been accounted for. This last point is not mentioned in any of the books dealing with the subject, and the reason for its occurrence is not yet apparent. The case containing the adult birds with three young ones in down in the local collection at the Welsh Museum, Cardiff, is well worth studying.

Kingfisher. *Alcedo ispida*. In July, 1904, a kingfisher was picked up dead on the sill of the bye-wash at Lisvane Reservoir. It was found to have been choked by a stickleback, which still remained fixed in the bird's gullet when it was found—a fate which not infrequently overtakes the kingfisher.

KINGFISHERS CAPTURED BY A CAT.—Mr. J. C. F. Morson (Cowbridge) writes to the *Field* under date, January 14, 1905 : A cat in the possession of the landlord of the *Butcher's Arms*,

Cowbridge, is in the habit of capturing kingfishers. At the date of his letter, she had brought in four of these birds from the neighbouring stream. Since then, four more have been caught by this cat, but were released by the young publican, who is a fisherman and a good sportsman, and much regrets the slaughter of these beautiful birds. The last four were captured in December. The stream on which this small town stands is the Thaw, a good little trout stream, the fish running up to 11lb., the average being 6oz. to 8oz. each. For five miles this stream wends its way to the Severn sea through the prettiest part of the Vale of Glamorgan. On no stream in England or Wales have I seen a greater number of kingfishers than I have on this. Walk down the stream almost any day you like, the chances are that you see two or three. I have to-day seen two. The place where these kingfishers were caught lies close to the town, a stone's throw from the town bridge. Thirty yards from this bridge is the town slaughter-house, and my impression is that the kingfishers perch on some willows which grow close to the slaughter-house and feed on the offal; at any rate this is the spot where all these kingfishers have been caught by the cat. The butchers who kill their beasts there tell me they often see the kingfishers there, and are quite sure that the birds feed on the offal. I may add that this particular cat, which has caught eight, had a kitten and kept bringing the birds in on its behalf. No doubt other cats have caught them unknown to their owners. In an editorial note, the *Field* remarks: It may be observed that under the Wild Birds Protection Acts kingfishers are protected generally between March 1 and Aug. 1. In the neighbourhood of Cardiff, by order of the Home Secretary, they are protected all the year round, and as regards South Wales it is illegal to take the eggs in the counties of Glamorgan, Brecon, and Pembroke.

Osprey. *Pandion haliaetus*. Mr. John Nicholl, when in company with Capt. C. Rankin, saw, on June 12, 1904, an osprey circling above them near the head of Towey at Twm Shon Catti's cave: again on August 12, he noticed another

circling at an immense height in the air at Merthyr Mawr, near the mouth of the Ogmore. The occurrence of the bird is recorded three times in the county between 1860 and 1895.*

Woodcock. *Scolopax rusticula*. Mr. Nicholl saw a woodcock on April 24, 1904, in the fir-woods under Candleston Castle. It (or another) was again seen in the same place on June 21 by his gamekeeper. This is the first recorded instance of the bird remaining during the summer in that particular locality. It has been known to breed in Wenwood, Penrice, Penllergaer, and probably Margam.

Golden Plover. *Charadrius pluvialis*. Mr. Nicholl notes that this species is more numerous than ever this winter at Merthyr Mawr. This may be explained by change of feeding-ground, as in another district of the county we learn they are not so plentiful as usual.

Wryneck. *Lynx torquilla*. On April 19, 1904, one of these rare summer visitors to the eastern side of this county was taken on the East Moors, Cardiff, and another was seen about this date near the railway embankment at Aberthaw by Mr. D. Sibbering-Jones, of Barry. This species has been known to nest in this county.†

Little Owl. *Athene noctua*. On October 25, a specimen of this rare little owl was caught in a trap set to catch stoats and weasels by the gamekeeper at Llantwit Major. Another instance where a little owl was caught in a trap set for a similar purpose in a run through a hedge, is recorded in our Notes for 1901.

Red-Throated Diver. *Colymbus septentrionalis*. On September 25, a male bird in beautiful plumage was shot at Fishguard.

Peregrine Falcon. *Falco peregrinus*. On October 31, a beautiful adult male was caught in a pole-trap by a local gamekeeper.

THE POLE-TRAP.—The following extract from the last Annual Report of the Royal Society for the Protection of Birds will be

* Birds of Glamorgan.

† Birds of Glamorgan.

read with much interest: "The year has been marked in a very satisfactory manner by the passing of an Act of Parliament drafted by the Council for remedying a notorious evil. For many years the Society fought against what Sir Herbert Maxwell has described as 'one of the scandals of game-preserving'—the employment of the pole-trap, with its hideous cruelty to the unfortunate victims doomed to die a lingering death within its clutches, and its indefensible destruction of rare, harmless, and 'protected' species. Richard Jefferies long ago bore witness to its gruesome success in the destruction of owls; ten years since Mr. Hudson pointed out, in a leaflet on *The Barn Owl*, published by the Society, how little it availed for County Councils to give protection on paper to these useful and beautiful birds while the barbarous pole-trap was allowed to exist on private estates, 'exterminating the owls inhabiting the country for miles around.' Correspondence on the subject in leading London papers in 1898 and 1900 was reprinted in leaflet form and widely circulated; and in 1898 a circular letter was addressed to 5,000 landowners and tenants of shootings, resulting in many expressions of sympathy reaching the Society, coupled with numerous indications that those to whom the letter was sent disliked the trap, and would be glad to forbid its use if their gamekeepers were of the same mind with themselves. The *Times*, *Field*, and other influential journals, supported the Society in its campaign. Continual protests to those on whose land the trap was known to be used, met with some encouraging responses; and references to the subject at annual meetings were certain of endorsement. In 1903 a Bill for the abolition of the trap was introduced into the House of Commons, but went no further than a first reading. In 1904 the attempt proved more successful, and special thanks are due to Mr. Sydney Buxton, the Society's hon. treasurer, for steering the measure through the Lower House, and to the Earl of Jersey, a vice-president, for securing its passage, with one slight amendment, through the House of Lords. It received the Royal Assent on April 30, 1904. It is difficult to enforce the Act,

but the Society trusts that landowners and shooting-tenants will insist upon the provisions of the law being complied with by those whom they employ. Notices of the new Act were sent by the Society to a number of landed proprietors, and also to the chief-constables of Great Britain and Ireland, who in turn distributed upwards of 1,200 copies of the notice among members of the force."

LUNDY ISLAND.—The following extract is taken from the Report of the Royal Society for the Protection of Birds: in connection with bird watching: "A special effort has been made at Lundy Island, off the coast of Devon, the one English breeding-place of the Gannet. Representations on the matter were received from Professor Newton, who reported the colony to be in imminent danger of extermination, not a single young bird having been reared for seven years. Lundy is nominally a protected area for all eggs, but owing to the peculiar circumstances of this quaint little seigniory the law had never been enforced, and while the inhabitants have regarded wild birds' eggs as a saleable requisite, visitors are stated to do an amount of egg-lifting which must seriously affect the interesting bird population of the island. By permission of the proprietor of Lundy, a watcher was engaged for the breeding season; warning notices were circulated; Pilotage Boards were asked to instruct their pilots; and the officials of Trinity House agreed to direct their Lundy lighthouse keepers to co-operate with the watcher in his task. Unfortunately the Gannets did not nest this year; but in consequence, it is believed, of the watching, Peregrines, Buzzards, and other rare birds succeeded in rearing their young. A watcher will be again on the island next summer."

NOTICES OF THE ARRIVAL OF SPRING MIGRANTS, 1904.

Mr. J. B. Pole Evans, Llanmaes :—

SWALLOW, March 21, on Flemingston Moors.

HOUSE MARTIN, April 4, on Flemingston Moors.

CHIFF-CHAFF, April 4, at Llanmaes.

WOOD-WARBLER, April 12, at Llanmaes.

Mr. T. W. Proger :—

SAND MARTIN, March 28, over Roath Park Lake.

SWALLOW, April 12, over Roath Park Lake.

Mr. D. Sibbering-Jones, Barry :—

CHIFF-CHAFF, April 1, at Barry.

NIGHTINGALE, April 17 (singing), Beggars' Hill Road, Barry.

Mr. Andrew Corbett, Pontcanna :—

BLACKCAP-WARBLER, April 17, at Pontcanna.

NIGHTINGALE, April 17, at Pontcanna.

Mr. D. Sibbering-Jones :—

SPOTTED FLYCATCHER, April 17, Aberthaw.

SANDPIPER, April 17, Aberthaw.

GRASSHOPPER WARBLER, April 25, near Barry.

Mr. J. Mountney, Taxidermist, Cardiff, sends the following list of the birds observed by himself and his sons in the Llandaff Fields :—

MISSEL-THRUSH.

SONG-THRUSH.

REDWING.

FIELDFARE.

BLACKBIRD.

REDBREAST.

REDSTART. *Rusticilla phoenicurus*. In the Palace meadow adjoining the field.

WHITETHROAT. *Sylvia cineria*.

BLACKCAP. *Sylvia atricapilla*.

GOLDEN-CRESTED WREN. *Regulus cristatus*. One watched at a distance of three feet.

CHIFF-CHAFF. *Phylloscopus rufus*.

WILLOW WREN. *Phylloscopus trochilus*. Heard singing in Llandaff Cemetery adjoining the Fields at 8 a.m., April 5, 1904.

HEDGE-SPARROW. *Accentor modularis*.

LONG-TAILED TITMOUSE. *Acredula cordata*.

GREAT TITMOUSE. *Parus major*.

COAL TITMOUSE. *Parus ater*.

BLUE TITMOUSE. *Parus coeruleus*.

NUTHATCH. *Sitta coesia*. Seen frequently in the old ash tree near the Drinking Fountain.

WREN. *Troglodytes parvulus*.

TREE-CREEPER. *Certhia familiaris*.

PIED WAGTAIL. *Motacilla lugubris*.

GREY WAGTAIL. *Motacilla melanope*.

YELLOW WAGTAIL. *Motacilla raii*.

MEADOW-PIPIT. *Anthus pratensis*.

SPOTTED FLYCATCHER. *Muscicapa grisola*. (Many times T. W. P.)

SWALLOW. *Hirundo rustica*.

MARTIN. *Chelidon urbica*.

GREENFINCH. *Ligurinus chloris*.

HOUSE-SPARROW. *Passer domesticus*.

CHAFFINCH. *Fringilla coelebs*.

LINNET. *Linota cannabina*.

BULLFINCH. *Pyrrhula europaea*.

YELLOW BUNTING. *Emberiza citrinella*.

STARLING. *Sturnus vulgaris*.

JACKDAW. *Corvus monedula*.

ROOK. *Corvus frugilegus*.

SKYLARK. *Alauda arvensis*.

SWIFT. *Cypselus apus*.

GREEN WOODPECKER. *Grecinus viridis*.

74 *Notices of the Arrival of Spring Migrants, 1904*

KINGFISHER. *Alcedo ispida*. April 14, 8 a.m., near the Mill.

CUCKOO. *Cuculus canorus*.

BARN OWL. *Strix flammea*.

TAWNEY OWL. *Syrnium aluco*.

KESTREL. *Falco tinnunculus*.

WILD DUCK (MALLARD). *Anas boscas*.

STOCK DOVE. *Columba oenas*.

BLACK-HEADED GULL. *Larus ridibundus*. Seen flying over.

NOTE ON SULLY ISLAND.

Mr. CHAS. E. EVANS has kindly sent us the following interesting particulars.—“When I first took over Sully Island some four years ago, the island was pretty well denuded of sea birds, but I am glad to say that by careful watching, and the employment of a man specially for the purpose, the island is now commencing to become the haunt of a number of wild fowl. This Spring, I am glad to say, I know of at least nine nests of sheldrake on the island, and, although the birds are late in laying, they are doing very well. One nest contained over thirty eggs, so it is evident that two birds have been laying in the same nest. One pair of Oyster Catchers have hatched out two eggs, some unprincipled person having taken two out of the nest. Another Oyster Catcher is just about bringing out two others, two eggs unfortunately having been broken by someone walking over the place where the bird had laid. For the first time in my knowledge, a pair of common wild duck have hatched out their young ones on the island. The kestrel is also nesting on the island, as she has done for many years in succession, and, in addition to these birds, some dozen clutches of plovers have been hatched out, and the Ringdottrel, Brown Linnet, Rock Pipit and numerous larks are also nesting and hatching their young. I dare say there are other birds on the island, but these are all I have been able to take note of. Occasionally a Cormorant and Heron visit the island, while in the winter time a number of other birds visit it, such as occasional wild geese, widgeon, teal and several birds that I cannot identify. In addition to the list given above, there are a couple of rock pigeons which have nested on the island this year. Sully Island is about the only place within an easy distance of Cardiff where these birds can nest in comparative peace, the result being that the Sheldrake and other birds are not only nesting on the island, but they are also beginning to nest in places along the cliffs. It is therefore to the interest of all bird lovers to help me in every possible way to protect the birds

nesting on Sully Island, as it makes a sanctuary for the distribution in our channel of some of the most beautiful of our birds.

“Members of the Naturalists’ Society will be interested in my various endeavours to establish a rookery. I am glad to say I have been successful, and this spring there are eighteen nests in the trees adjoining the ‘Spinny,’ the result of bringing a number of rooks up by hand on the verandah, putting up dummy nests in the trees, and the transference of a couple of nests from the neighbouring rookery at Sully Village with the young ones in, the old birds having followed and fed them after the nests had been placed in the trees at the ‘Spinny.’”

BIOLOGICAL & GEOLOGICAL SECTION.

REPORT FOR THE SEVENTEENTH SESSION, 1903-4.

COMMITTEE :

The PRESIDENT and HON. SECRETARY of the C.N.S. (*ex officio*).

T. H. THOMAS, R.C.A., *President*.

WENTWORTH H. PRICE.

A. H. TROW, D.Sc., F.L.S.

J. J. NEALE

T. W. PROGER

W. N. PARKER, Ph.D., *Hon. Sec.*

} *Hon. Secs. for Field Walks.*

The number of members on the books is 48. Five ordinary meetings and a special meeting (February 19) have been held in the course of the Session, with an average attendance of 14.6. The Annual Meeting was held in association with the first Field Walk on June 1.

The following papers were read :—

November 12, 1903.

C. T. VACHELL, M.D., "On the Disappearance of a Complete Natural Order from the Society's District."

December 10.

R. DRANE, F.L.S., "Biological Futilities from the Far Frontier," illustrated by lantern slides prepared by members of Mr. Neale's family.

February 11, 1904.

T. L. HOWE, Notes on the Vitality of Moths and on the Stag-beetle.

February 19.

J. B. HAYCRAFT, M.D., D.Sc., "The Elasticity of Organic Bodies," illustrated by lantern slides and experiments.

March 10.

W. S. BOULTON, B.Sc., F.G.S., "Some Recent Work among the Volcanic Rocks of Somersetshire."

H. J. RANDALL, JUN., "Eoliths."

The following exhibits were also made and commented upon :—

October 22, 1903.

J. J. NEALE. (a) Three orchids (*Masdevallia muscosa*, *M. bella*, and *M. troglodytes*; (b) Lower jaw of *Scymnus*; and (c) *Retepora*.

T. H. THOMAS. Sketch of Horn-cores of *Bos* found in 1842 at Penarth Dock, at a depth of 7 ft.

W. E. DAVEY. Cambrian Slates, showing "worm-tracks."

G. H. SCOTT. Adder 23½ in. long, showing colour-variation.

W. N. PARKER. (a) Nest of living *Lasius flavus*; (b) Bats from the College Museum; and (c) Ainsworth Davis's "Natural History."

November 12.

A. MCKINNON. Coloured lantern slides of plants and butterflies.

J. J. NEALE. Two deep-sea fishes.

T. W. PROGER. Living dormouse and hedgehog.

February 11, 1904.

G. R. BROOK. Mounted dissections of scallop and gudgeon.

W. N. PARKER. Head of *Ovis dalli*, from Alaska, recently presented to the College by Mr. David Davies of Llandinam.

March 10.

J. J. NEALE. Seedling of gorse, two aroids, and *Odontoglossum crispum-guttatum*.

T. H. THOMAS. Fuchsia leaves cut by leaf-cutting bee.

G. R. BROOK. *Centiscus scolopax*, taken from stomach of hake.

W. N. PARKER. Head of *Scymnus lichia* received from Mr. Neale.

Various alterations in the Rules have been made, the most important of which refer to the relaxation in favour of admitting members to the Section who are not members of the Parent Society, and to the admission of ladies.

A sub-committee was formed to report on the methods of procedure to be adopted in preparing a new edition of Storrie's

Flora. The following were elected on the sub-committee, with power to add to their number: Messrs. Drane, Neale, Proger, Gilbert Scott, T. H. Thomas, Trow, Miss Vachell, and Dr. C. T. Vachell (convener).

After receiving an informal report from the convener, a grant of £2 was made to this sub-committee for expenses in connection with the work; and a resolution relating to the destruction of rare plants in the Society's district was forwarded to the Parent Society with a recommendation that it should be adopted.

The accounts have been audited by Drs. Harrison and Trow, and show a balance in hand of £20 os. 7d., of which £20 has been placed on deposit at Lloyds Bank.

W. N. PARKER,
Hon. Sec.

UNIVERSITY COLLEGE, CARDIFF,
May 30, 1904.

BIOLOGICAL AND GEOLOGICAL SECTION:

Account of Receipts and Payments for Session 1903-4.

RECEIPTS.		£	s.	d.
To Balance in hand, September 30, 1903	...	20	17	7
" 37 Subscriptions at 2s. 6d.	...	4	12	6
		<hr/>		
		25	10	1

PAYMENTS.		£	s.	d.
By Cost of Meetings, including Lantern, Attendance, Collection of Subscrip- tions, etc.	...	1	18	7
" Postages	...	0	17	11
" Grant to <i>Flora</i> Sub-Committee	...	2	0	0
" Sundries	...	0	13	0
" Balance, September 30, 1904	...	20	0	7
		<hr/>		
		25	10	1

Audited and found correct,

H. S. HARRISON.
A. H. TROW.

W. N. PARKER, *Hon. Sec.*
UNIVERSITY COLLEGE, CARDIFF,
May 30, 1904.

ARCHÆOLOGICAL SECTION.

REPORT ON SESSION 1903-4.

OFFICERS AND COMMITTEE.

<i>President</i>	J. S. CORBETT.
<i>Hon. Sec. and Treasurer</i>	J. W. RODGER.
<i>Vice-Presidents :</i>	
C. H. JAMES, J.P.	R. DRANE, F.L.S.
W. RILEY, J.P.	G. E. HALLIDAY, F.R.I.B.A.
C. T. VACHELL, M.D., J.P.	T. H. THOMAS, R.C.A.
E. SEWARD, F.R.I.B.A.	G. SEABORNE.
<i>Committee :</i>	
J. WARD, F.S.A.	P. RHYS GRIFFITHS, M.B.
J. COATES-CARTER, F.R.I.B.A.	C. H. FARNSWORTH.
A. B. BASSETT.	H. T. GILLING, B.A., LL.B.
J. H. WESTYR-EVANS.	

FINANCIAL STATEMENT.

A balance sheet is submitted herewith, showing a credit balance of *9s. 11d.*

MEMBERSHIP.

The total membership is 52, being an increase of 4 on last Session. Four papers were read during the winter of 1903-4, at which the average attendance was 17.

PAPERS.

Papers were read as follows :—

- Oct. 26, 1903.* Mr. T. H. Thomas, R.C.A. : "Pontypool and Usk Japan."
Nov. 19, 1903. Rev. John Griffith : "Prehistoric Rhondda."
Jan. 15, 1904. Mr. R. Drane, F.L.S. : "Futilities in Irish Archæology."
April 15, 1904. Mr. W. Riley, J.P. : "The Prehistoric Men of Merthyr Mawr."

FIELD DAYS.

June 4, 1904. An excursion was arranged to Merthyr Mawr sandhills, but owing to the unfavourable weather it did not take place.

Oct. 1, 1904. The members of the Section united with the general members of the Society in visiting Castell-mor-Graig on Thornhill, to inspect the ruins of the castle now being explored.

EXPLORATION WORK.

The work of exploration at Castell-mor-Graig, on Thornhill, near Cardiff, which was started in the summer of 1903 by the Section, has been continued throughout the summer of this year, the expense being again defrayed by Lord Windsor.

The pitched roadways leading to the Castle are being uncovered, and this will probably form the closing work of the year. The work has again been carried out under the direction of Mr. John Ward, F.S.A., and under the close personal supervision of Mr. W. Clarke of Llandaff, to whom the thanks of the Section are especially due.

A full report for publication in the Transactions is now in course of preparation.

GIFTS.

The Committee have pleasure in acknowledging a gift of 72 beautiful half plate photographs of Glamorganshire Antiquities from Mr. Rolande Reynolds of Dinas Powis. This collection of photographs is arranged in a special album, and is known as the "Reynolds" Collection.

JOHN W. RODGER,
Hon. Sec.

14, HIGH STREET, CARDIFF,
October 28, 1904.

CARDIFF NATURALISTS' SOCIETY.

ARCHÆOLOGICAL SECTION.

Account of Expenditure and Receipts for the year ending September 30, 1904.

EXPENDITURE.			£	s.	d.	RECEIPTS.			£	s.	d.
To General Expenses and Postages	...	1	12	0		By Balance from last year's account	...	0	8	11	
" Stationery and Printing	...	2	6	6		" Subscriptions	...	5	7	6	
" Cost of Meetings	...	0	19	0		" Subscriptions not paid	...	1	5	0	
" Expenses in connection with Castell-mor- Graig Exploration	...	1	0	6							
" Cost of "Suggestion" Book	...	0	6	0							
" Cost of Index Map of Glamorganshire	...	0	2	6							
" Commission to Collector	...	0	5	0							
" Balance	...	0	9	11							

£7 1 5

CHAS. H. FARNSWORTH,
Hon. Auditor,

CARDIFF, December 17, 1904.

£7 1 5

JOHN W. RODGER,
Hon. Sec.,

CARDIFF, October 28, 1904.

REPORT OF THE COMMITTEE

For the Year 1903-4.

The Committee have pleasure in submitting to the members the Thirty-seventh Annual Report of the Society.

The number of members at the close of last

Session was	...	...	...	...	447
Elected during 1903-4	...	...	...	...	25

472

Resignations and Removals...	...	...	...	...	57
Deaths	...	...	...	...	12
				—	69

403

The members are thus distributed :—

Honorary Members	...	...	...	...	8
Life Members	...	...	...	...	18
Corresponding Members	...	...	...	...	11
Annual Subscribers	...	...	...	...	366

403

The Committee much regret to record the loss by death during the past Session of 12 members of the Society, viz. : Sir Thomas Morel, David Richards (Maindy), E. Hancock, Franklen G. Evans, S. Wilson, S. Coleman, J. L. Smith, Mrs. G. Bowden, W. Lawson Jones, Evan Evans, H. Kirkhouse, and E. Irvine Jordan.

In Mr. Franklen Evans the Society loses an old and valued member, some time President of the Society. Mr. Franklen Evans furnished the Meteorological Reports for the Society's Transactions from 1886 to 1896. An obituary notice of Mr. Franklen Evans will appear in the forthcoming volume of the Transactions.

The following is a list of the Papers read before the Society,
viz. :—

1903.

- Oct. 15. Annual Meeting. Presidential Address by T. W. Proger, Esq., entitled—"Some Material for a 'Fauna of Glamorgan.'" ,,
29. W. W. Pettigrew, Esq. "The Botanical Garden in Roath Park."
Nov. 26. Wentworth H. Price, Esq. "Mountain Climbing."
Dec. 3. George Harding, Esq., F.E.S. "Microscopic Fungi."

1904.

- Jan. 21. E. Doran Webb, Esq., F.S.A. "Shaftesbury and its Abbey Church."
Feb. 18. W. G. Savage, Esq., M.D. "The Germ Theory of Disease."
Mar. 17. W. S. Boulton, Esq., F.G.S. "The Geology of the South Wales Coalfield."

The following Public Lectures have been delivered during the year, viz. :—

1903.

- Nov. 6. Professor Karl Pearson, M.A., LL.B., F.R.S. "Natural Selection at Work in Man."
Dec. 17. Francis Darwin, Esq., M.A., M.B., F.R.S. "The Movements of Plants."

1904.

- Jan. 7. A. E. Shipley, Esq., M.A., F.Z.S. "Deep Sea Animals."
Feb. 4. Fred Enock, Esq., F.L.S. "Nature's Protection of Insect Life."
Mar. 3. Hilaire Belloc, Esq. "The Mediæval Village."
April 14. Professor Vivian B. Lewes, F.I.C., F.C.S. "The Incandescent Mantle."

The thanks of the Society are due to the members who have read papers, and also to those who entertained the lecturers. During the session Public Lectures have been given in the Cory Hall, and the Members' nights held in the Y.M.C.A. Hall.

The first Field Meeting was held on June 15, when an interesting visit was paid to the Newport Glass Works. Some 60 members attended, who were conducted over the Works by the Manager and his assistants. Subsequently the party was entertained to tea at the Westgate Hotel, Newport, by the President, Mr. T. W. Proger.

The Annual Field Meeting (Ladies' Day) was held on Wednesday, July 6, and was attended by 70 members. Bradford-on-Avon was visited, the party proceeding to Bath by train, and thence driving to Bradford along the beautiful valley south of the Avon, a halt being made at Farleigh Castle en route. After lunch the members were conducted round the town by Dr. J. Beddoe, F.R.S., and Mr. Harold Brakspear, F.S.A., and inspected the ancient buildings and other objects of interest, being subsequently entertained to tea at "The Chantry" by Dr. and Mrs. Beddoe, the return drive to Bath being made north of the Avon.

A very enjoyable and successful day was spent on July 30th. An "Extra" Field Meeting was held, a visit being paid to the New Town Hall and Law Courts. A large number of members availed themselves of the kind permission granted by the Corporation Authorities, and were conducted over the buildings by Mr. Howell, the Clerk of the Works, and Mr. William Turner, representing Messrs. E. Turner & Sons, the contractors.

The Third Field Meeting was held on October 1, a visit being paid to the mediæval fortress recently excavated by the Archæological Section at Castell-mor-Graig, near Caerphilly. On the outward journey a Roman pavement recently excavated at Andover, Hants, was inspected at Mr. William Clarke's, at Llandaff. The following gentlemen kindly conducted the party:—Messrs. John Ward, J. W. Rodger and William Clarke. The members were most hospitably entertained to tea by Mr. Emile Andrews, at New House, Thornhill.

The work of exploration at Castell-mor-Graig, on Thornhill, near Cardiff, which was started in the summer of 1903 by the Archæological Section, has been continued throughout the

summer of this year, the expense being again defrayed by Lord Windsor. The four circular bastions have been thoroughly cleared of the earth and débris with which they were filled, and the walls generally have been exposed. Many interesting architectural details have come to light which prove it to have been a mediæval fortress of considerable architectural pretensions. The walls are of great strength, varying from seven feet to nine feet in thickness, the outer walls of the "keep" being uniformly nine feet eight inches thick. Further excavations are still in progress. The work has again been carried out under the direction of Mr. John Ward, F.S.A., and under the close personal supervision of Mr. W. Clarke, Llandaff, and Mr. J. W. Rodger.

During the year Volume XXXVI. of the Transactions has been issued, containing, in addition to the usual matter, the Catalogue of the Society's Library, the Index to the Transactions Vols. XVIII.-XXXVI., and a list of the members of the Society.

The Committee have much pleasure in acknowledging the valuable work which Mr. Henry Heywood continues to do in furnishing the Meteorological Report for the Transactions.

Principal E. H. Griffiths and Dr. A. H. Trow attended the Conference of Corresponding Societies at the Annual Meeting of the British Association at Cambridge as the Society's delegates. Principal Griffiths was appointed President of the Conference. The Society's delegates brought before the Conference certain suggestions from your Committee, having for their object the promotion of united work by the various Societies.

The Annual Statement of Accounts is presented herewith.

CARDIFF NATURALISTS' SOCIETY.

ESTABLISHED 1867.

Past Presidents.

- 1868—WILLIAM ADAMS, C.E., F.G.S.
- 1869—WILLIAM ADAMS, C.E., F.G.S.
- 1870—WILLIAM ADAMS, C.E., F.G.S.
- 1871—WILLIAM ADAMS, C.E., F.G.S.
- 1872—WILLIAM ADAMS, C.E., F.G.S.
- 1873—WILLIAM ADAMS, C.E., F.G.S.
- 1874—FRANKLEN G. EVANS, F.R.A.S., F.R.M.S.
- 1875—JOHN WALTER LUKIS, M.R.I.A.
- 1876—WILLIAM TAYLOR, M.D., ETC.
- 1877—JOHN WALTER LUKIS, M.R.I.A.
- 1878—COLONEL PICTON TURBERVILL.
- 1879—HENRY HEYWOOD, C.E., F.C.S.
- 1880—LOUIS TYLOR.
- 1881—CLEMENT WALDRON.
- 1882—GEORGE E. ROBINSON.
- 1883—WILLIAM GALLOWAY.
- 1884—PETER PRICE.
- 1885—C. T. VACHELL, M.D.
- 1886—HENRY HEYWOOD, C.E., F.C.S.
- 1887—J. V. JONES, M.A.
- 1888—T. H. THOMAS, R.C.A.
- 1889—W. RÖNNFELDT.
- 1890—J. GAVEY.
- 1891—C. T. VACHELL, M.D.
- 1892—C. T. VACHELL, M.D.
- 1893—C. T. WHITMELL, M.A.
- 1894—EDWIN SEWARD, F.R.I.B.A.
- 1895—R. W. ATKINSON, B.Sc., F.I.C.
- 1896—REV. CANON THOMPSON, D.D.
- 1897—ROBERT DRANE, F.L.S.
- 1898—J. TATHAM THOMPSON, M.B.
- 1899—C. T. VACHELL, M.D.
- 1900—W. N. PARKER, Ph.D.
- 1901—J. J. NEALE.
- 1902—C. H. JAMES.
- 1903—D. R. PATERSON, M.D.
- 1904—T. W. PROGER.

OFFICERS AND COMMITTEE, 1904-5

President.

P. RHYS GRIFFITHS, M.B.

Vice-Presidents.

C. H. JAMES, J.P.; D. R. PATERSON, M.D.; T. W. PROGER.

Hon. Treasurer.

WENTWORTH H. PRICE, F.C.A.

Hon. Curator.

T. W. PROGER.

Hon. Librarian.

P. RHYS GRIFFITHS, M.B.

Hon. Secretary.

WILLIAM SHEEN, M.S., M.D., F.R.C.S.

Committee.

G. A. S. ATKINSON, B.Sc., F.R.A.S.

G. A. BIRKENHEAD.

Rev. DAVID DAVIES, M.A.

Principal E. H. GRIFFITHS, Sc.D., F.R.S.

J. B. HAYCRAFT, M.D., D.Sc., F.R.S.E.

E. P. PERMAN, D.Sc., F.C.S.

W. W. PETTIGREW.

J. W. RODGER, M.S.A.

W. GILBERT SCOTT.

W. J. TROUNCE, J.P.

A. H. TROW, D.Sc.

J. E. WILLIAMS, M.A.

"Also such of the Past Presidents as shall in reply to an annual circular consent to serve on the Committee."

BIOLOGICAL AND GEOLOGICAL SECTION.**President.**

T. H. THOMAS, R.C.A.

Hon. Secretary.

JOSEPH PEARSON, B.Sc., University College.

ARCHÆOLOGICAL SECTION.**President.**

J. S. CORBETT.

Hon. Secretary.

J. W. RODGER, M.S.A., 14, High Street.

CARDIFF NATURALISTS' SOCIETY.

Dr. Revenue Account for the Year ending September 30, 1904. Cr.

	£	s.	d.		£	s.	d.
To Reports and Transactions	80	18	8	By Balance from last year's Account ..	320	15	11
" Members' Meetings	40	8	11	" Subscriptions—Ordinary ..	292	0	0
" Stationery, Printing and Advertising ..	18	16	9	" " —Life ..	5	5	0
" General Expenses	40	12	2	" Dividends and Interest ..	11	1	6
" Field Meetings	11	18	8	" Hire of Screen ..	0	10	0
" Lectures	115	8	6				
" Conversazione Reserve Account ..	9	12	0				
" Endowment of Research Account ..	38	8	0				
" Depreciation of Furniture .. £3 7 9							
" Do. Library .. 1 11 6							
	4	19	3				
" Balance to be carried to next year's Account ..	268	9	6				
	£629	12	5				
					£629	12	5

CARDIFF NATURALISTS' SOCIETY.

Dr.

Balance Sheet, September 30, 1904.

Cr.

LIABILITIES.				ASSETS.			
	£	s.	d.		£	s.	d.
Sundry Creditors ...	88	12	3	Value of Furniture ...	...	...	...
Subscriptions paid in advance ...	1	10	0	Value of Library ...	...	...	33 14 6
Conversazione Reserve Account...	48	15	1	Value of Reports unsold	...	...	3 0 0
Endowment of Research Account	78	6	11	Value of <i>Flora</i> unsold	...	...	5 0 0
Gellygaer Excavations Account ...	15	3	0	Barry Railway Company, £200 4 per cent.	...	...	0 11 4
Balance, being excess of Assets over Liabilities	268	9	6	Preference Stock (at cost) including the amount of the Life Subscriptions	...	...	42 5 10
				Subscriptions in Arrear ...	...	...	252 19 7
				Cash at Lloyds Bank, Ltd., viz. :—	...	...	7 10 0
				Deposit Account	...	...	130 12 10
				Current Account	...	...	67 8 6
					...	...	198 1 4
							£500 16 9

WENTWORTH H. PRICE, F.C.A.,

Hon. Treasurer.

CARDIFF,

October 4, 1904.

T. W. PROGER,

Hon. Auditor.

CARDIFF,

October 6, 1904.

CARDIFF :
WILLIAM LEWIS, PRINTER, DUKE STREET.

TRANSACTIONS OF THE CARDIFF NATURALISTS' SOCIETY.

VOL. XXXV.

1903.

THE GELLYGAER
EXCAVATIONS.

TRANSACTIONS OF THE CARDIFF NATURALISTS' SOCIETY

VOL. XXXVI

1903

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